

Information exchange as a potential cue for sport team cohesion

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ABSTRACT

Group cohesion has been identified as an important construct in sport given its association with a number of individual and team outcomes. Within the extant literature, however, less attention has been devoted to the cues that individual athletes use to form cohesion perceptions. According to the assumptions underpinning the current conceptualization of sport group cohesion, athletes will consider both individual experiences within the team and the actual reality of the team as a whole when formulating perceptions of the team's cohesiveness. One variable that could serve as a source of information for cohesion perceptions that captures this individual/team interface is member communication. The general purpose of the studies in this dissertation was to test communication as information exchange as a potential cue to cohesion. To increase the reliability of the findings, a series of studies that employed different samples, measurement tools, and study designs were used in an effort to replicate and extend the current knowledge base. Study 1 established the relationship between member information exchange and task cohesion, while controlling for social properties of communication (i.e., acceptance, distinctiveness, positive conflict, and negative conflict) and team performance. Results revealed that information exchange contributed unique variance in task cohesion over and above the social properties of communication. Studies 2 and 3 together tested the information exchange/cohesion relationship using social network analysis. The results of Study 2 revealed that team sport athletes who exchanged information with a larger proportion of their teammates on a regular basis reported higher task cohesion than those interacting with a moderate or smaller proportion of teammates. Using a hypothetical vignette design in Study 3, the proportion of information exchange occurring at the individual and team level was varied. The results showed that those exposed to the team vignette where individual members exchanged information with a larger proportion of teammates and the team as a whole engaged in higher information exchange reported higher anticipated task cohesion than those exposed to the vignette reflecting lower levels of information exchange. Together, the results of Studies 2 and 3 revealed that when individuals engaged in information exchange with a larger proportion of teammates, and this pattern translated to the team as a whole exchanging information, task cohesion perceptions also were higher. The design of Study 4 built on the findings of the hypothetical vignettes to examine the information exchange network structure and task cohesion of two intact teams competing in one game. The information exchange network structures were obtained from the members of the

winning and losing teams. The results revealed that the members of the winning team reported higher information exchange at the individual and team level as well as higher perceptions of task cohesion than the losing team. As the findings of the first four studies were based on concurrent designs, Study 5 tested the information exchange/task cohesion relationship using a sample of intact teams and a prospective design. Overall, the findings from the last study suggested that over the first half of the competitive season, a higher proportion of early season information exchange at the individual level was significant in predicting task cohesion perceptions at midseason. Further, a higher proportion of early season information exchange at the team level was significant in predicting midseason team performance. Taken together, the results from all five studies provide initial evidence for viewing communication as information exchange as a potential cue to task cohesion. Further, the findings offer a foundation from which information exchange as an actual cue to cohesion can be tested using an experimental manipulation with intact sport teams.

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CHAPTER 1

GENERAL INTRODUCTION

Groups represent a pervasive aspect of modern society, with conservative estimates suggesting the presence of around 30 billion groups currently in existence (Forsyth, 2014). Membership and involvement in groups span the boundaries of family, education/work, and social endeavors. Given its pervasiveness, it is likely not surprising that belonging to a group has been identified as a fundamental human need (e.g., Baumeister & Leary, 1995). Thus, the study of groups is important.

Sport is one setting where groups are found (Eys & Evans, 2017; Spink, 2016). These group settings range from the typical group sport types such as basketball, volleyball, or ice hockey, to more independent group sport types such as golf, wrestling, or track and field (Evans, Eys, & Bruner, 2012). In sport group dynamics research, one specific variable that received a great deal of attention is the degree to which the members of a sport team believe that the team is cohesive (Carron, Widmeyer, & Brawley, 1985). In fact, group cohesion has been identified as the most important small group variable by some researchers (Lott & Lott, 1965).

In sport, group cohesion is defined as "...a dynamic process which is reflected in the tendency for a group to stick together and remain united in pursuit of its instrumental objectives and/or for the satisfaction of member affective needs" (Carron, Brawley, & Widmeyer, 1998, p. 213). Positive links have been established between cohesion and many important factors including situational (e.g., group size; Widmeyer, Brawley, & Carron, 1990), team (e.g., role perceptions; Benson, Eys, & Irving, 2016), leadership (e.g., coach-initiated motivational climate; McLaren, Eys, & Murray, 2015), and personal factors of the group (e.g., precompetitive anxiety; Wolf, Harenberg, Tamminen, & Schmitz, in press). Less attention, however, has been paid to the sources of information that individual athletes use to form these cohesion perceptions. As cohesion has been associated with the numerous outcomes noted above, identifying the factors that could be manipulated to alter it become important.

The process of forming cohesion perceptions has been described in general at the conceptual level. According to Carron and colleagues (e.g., Carron & Brawley, 2000; Carron, Brawley, & Widmeyer, 2002), athletes will consider information from two sources in formulating cohesion perceptions. First, they will consider their own personal experiences within the social situation of the team. For instance, personal experiences could range from interacting

with other teammates, individual role responsibilities, or starting status. In addition, athletes also will consider sources of information that pertain to the team as a collective. This could include collective information sources such as team norms, performance, or structure. Together, these individual and team sources of information are selectively filtered and interpreted in a way that provides an estimation as to the unity of the team in its pursuit of different team goals and objectives (i.e., cohesion). This individual/team interface to forming cohesion perceptions described by Carron and colleagues (e.g., Carron, Brawley, et al., 2002) is an important consideration that is largely absent from the cohesion research. Further, the question arises as to what individual and team sources of information will be used by members to estimate cohesion. The focus of this dissertation was on one of these sources—team member communication.

1.1 Member Communication in Sport

It has been argued that communication is a fundamental, constituent element that differentiates a group from a collection of individuals (McGrath, 1984). It has been defined as a social process whereby two or more individuals exchange symbols that are relevant to a context or environment (Mabry & Barnes, 1980). Communication between members on sport teams is important for at least two main reasons. First, teams need to navigate an uncertain, dynamic environment with an opponent, which requires regular communication. Second, each member of the team has a specific role that comes with an expected set of responsibilities, and in order for members to coordinate their actions in an effective way, a degree of communication is required.

Member communication also has been linked to cohesion perceptions. In sport and other activity settings, member interactions feature in teambuilding models for cohesion (Carron & Spink, 1993). In these models, communication and interaction processes are identified as the throughput by which the group environment and group structure (inputs) come to impact perceived cohesion. In addition, communication is identified as one teamwork process (mediator) in a recent conceptual framework for teamwork and team performance (McEwan and Beauchamp, 2014). These authors suggested that team cohesion is an emergent state that arises from, among other team processes, the communication among team members. In terms of sport communication, the majority of research to date has focused on the content of social interactions between teammates.

1.2 Social Properties of Member Communication

According to Sullivan and colleagues (e.g., Sullivan & Feltz, 2003; Sullivan & Short, 2011), the communication between members of a sport team is an example of the social exchange of resources required to satisfy the task and social agendas of teams. They view communication through a social lens in that the specific content or a property of these interactions is the focus. Specifically, four properties of intra-team communication are identified that capture these social communication properties. These include appreciation and consideration of other teammates (acceptance), a shared and inclusive identity that is distinct from other groups (distinctiveness), constructive forms of member conflict (positive conflict), and expressions of destructive forms of member conflict (negative conflict) (Sullivan & Short, 2011).

1.2.1 Social communication properties and group cohesion

These social communication properties have been related to perceived group cohesion (e.g., Kim, Magnusen, & Andrew, 2016; McLaren & Spink, 2018; Smith, Arthur, Hardy, Callow, & Williams, 2012; Sullivan & Feltz, 2003; Sullivan & Short, 2011). While some of the specifics have differed across studies, the general consensus among researchers is that the more positive social properties (i.e., acceptance, distinctiveness, and positive conflict) are positively associated with perceived group cohesion, and the negative social property (i.e., negative conflict) is negatively associated with cohesion. Within this small literature base, it is clear that communication conceived as a social property features in an athlete's perceptions of team cohesiveness (Sullivan & Short, 2011). However, it has been suggested that there may be more to member communication that could inform our understanding of communication as a potential cue to cohesion (Eccles & Tenenbaum, 2004). Whereas the previous findings speak to the way teammates communicate, it also is possible to view this process through a more functional lens.

1.3 Member Communication as Information Exchange

Viewing communication as a functional form of communication requires the consideration of the informational components of member interactions. In part, to view communication in this manner means that groups are considered from a systems perspective—as an information- processing unit (e.g., Hinsz, Tindale, & Vollrath, 1997; Reimer, Park, & Hinsz, 2006). Returning to the sport context, the dynamic nature of competition requires that members share knowledge and information with one another in real-time during a game. This requires a degree of cooperation between teammates in an effort to facilitate the joint achievement of team

goals (Lee, 1997). So how might the exchange of information between team members serve as a source of information in forming perceptions of cohesion?

1.3.1 Information exchange and group cohesion

Consideration of the relationship between information exchange and group cohesion has its roots in early group dynamics theorizing. For instance, Cartwright (1968) noted that individual group members will weigh the incentive properties of a group to determine if they complement a motive base related to their personal membership. How might the exchange of information between members act as an attractive group process that would function as an incentive to remain as a member? Cartwright (1968) argued that members of complex, task-based groups are more likely to be satisfied with their group membership (and hence more likely to remain) when they are involved in the communication and interaction processes within the group (i.e., communicate with many others). As members come to take part in and experience the exchange of information with others, the resultant could be an increase in the perception of members that teammates are ‘all in’, which could, in turn, lead to higher perceived cohesiveness.

With one exception (Cranmer & Myers, 2015), our understanding of the relationship between information exchange and group cohesion comes from the broader organizational psychology context (e.g., Bakar & Sheer, 2013; Balkundi & Harrison, 2006; DeChurch & Mesmer-Magnus, 2010). The evidence suggests that when members of task-based teams engage in a higher amount of information exchange they also perceive the team to be more cohesive. Given the similarities between work and sport settings (Cannon-Bowers & Bowers, 2006), it follows that sport team members who exchange information with one another also should perceive higher cohesiveness.

Given the multidimensional nature of cohesion, it is assumed that the exchange of information between athletes should best serve as a potential cue for the instrumental (task) aspects of cohesion as opposed to the social. The latter are likely to be related more to affective-related properties of communication (e.g., demonstrations of warmth, friendships; Lott & Lott, 1965). Further, information exchange is situated more at the group level of functioning, which means that it was appropriate to test this group process as a potential cue for task cohesion related to the group as a totality (i.e., group integration-task; Carron et al., 1985).

1.4 Program of Research

The overarching purpose of this dissertation was to test the relationship between member information exchange and task cohesion in sport teams. In doing so, this would represent a preliminary step in understanding information exchange as a potential cue for cohesion. Given the limited knowledge base to date informing sport psychological research, a series of first-generation research questions (Zanna & Fazio, 1982) were posed in an attempt to gradually build this foundation. This was done by sampling different populations of team sport athletes, using multiple study designs, and generating data from different measurement tools (Klein, Shepperd, Suls, Rothman, & Croyle, 2014). Each study in this dissertation builds on the results of the previous study to situate better the boundaries of the information exchange/task cohesion relationship (e.g., moderating effects of sample, study artifacts, temporal considerations). Social psychological researchers have identified this progression of studies as a constructive replication—the introduction of new study design elements that either refine or extend the current boundaries of a relationship between two constructs (Huffmeier, Mazei, & Schultze, 2016). The following descriptions provide an overview of each of the studies in this dissertation.

1.4.1 Information exchange as a unique predictor of task cohesion

Past research has identified a relationship between cohesion and social communication properties (i.e., acceptance, distinctiveness, positive conflict, and negative conflict; Kim et al., 2016; McLaren & Spink, 2018; Smith et al., 2013; Sullivan & Feltz, 2003; Sullivan & Short, 2011). However, as mentioned above, less is known about how functional communication properties (i.e., information exchange) might relate to sport group cohesion. Does information exchange predict unique variance in task cohesion when controlling for the social properties of communication as a predictor of task cohesion? The purpose of Study 1 was to examine these relationships in a sample of team sport athletes from multiple sport types and competitive levels. Given that performance has been identified as a predictor of task cohesion in sport (e.g., Carron, Colman, Wheeler, & Stevens, 2002), team performance was entered as a control variable to better isolate the unique variance of the different communication properties.

1.4.2 Information exchanges as a social network

To better understand information exchange as a potential source of information for cohesion, it was necessary to build upon the relationships established using the individual perceptions examined in Study 1. If athletes report higher information exchange occurring within

the context of the team, it is not possible to specify whether these athletes are referencing their own personal interactions, the team as a collective, or some combination of the two. As it has been suggested that individual and team aspects are selectively filtered and interpreted in a way that forms an athlete's perception of cohesion (Carron & Brawley, 2000; Carron, Brawley, et al., 2002), teasing out the individual/team distinction in communication is warranted.

Using social network analysis, one possibility is to identify exactly with whom an individual athlete exchanged information. As well, it also is possible to identify how all athletes on a team collectively exchange information (Borgatti, Everett, & Johnson, 2013). Before addressing these different sources of communication, it was necessary to examine whether task cohesion perceptions could be differentiated based on the number of teammates with whom an individual exchanged information. Would a network size-cohesion relationship exist wherein task cohesion perceptions increased as the size (proportional) of a personal information exchange network also increased? This formed the purpose for Study 2.

The purpose of Study 3 was to build upon these findings and consider the whole team information exchange network. In this way, both the information exchange behaviours of each member and the information exchange of the team as a whole could be considered together in relation to perceived task cohesion. Using a vignette-based approach (Mehra et al., 2014), two team networks that differed in individual- and team-level information exchange were contrasted to test for differences in perceived task cohesion.

1.4.3 A comparison of two teams that differed in team performance outcome

Study 4 added team performance outcome to the study design. In past research, information exchange network structure and group cohesion independently have been associated with performance (e.g., Balkundi & Harrison, 2006; Carron, Colman, et al., 2002). To control for potential task demand changes (Kerr, 2017), the sample comprised of two teams competing in a single head-to-head game and the communication network structure and perceived task cohesion of the winning and losing teams were compared. Further, generating the whole team networks of intact sport teams would add to the information gathered from the hypothetical teams used in Study 3.

1.4.4 A prospective analysis of information exchange network structure, task cohesion, and team performance

Building on the findings from Studies 1 to 4, the purpose of the final study was to test the stability of information exchange as a predictor of task cohesion. This was done using a design where the network structure measure preceded the assessment of task cohesiveness (Cronin, Weingart, & Todorova, 2011). Further, assuming the patterns with team performance outcome found in Study 4 would continue, Study 5 also tested the relationship between information exchange network structure and team performance. A large sample of intact sport teams was used to generate a range of information exchange networks from teams in their real-world context. As such, the information exchange patterns of individual athletes can be considered in light of the way the team as a whole exchanged information. This would allow for a better test of Carron and colleagues' supposition that cohesion perceptions are formed in part from personal experiences and the actual reality of the group as a whole (Carron & Brawley, 2000; Carron, Brawley, et al., 2002). Specifically, the proportion of teammates with whom an individual athlete exchanged information, as well as the pattern of information exchange of the entire team could serve as predictors of task cohesion. In addition, this study was conducted across a time in the lifespan of a group where communication has been found most related to perceived cohesion and performance (i.e., the early portion of group development; Balkundi & Harrison, 2006).

CHAPTER 2

STUDY 1: EXAMINING THE RELATIONSHIP BETWEEN COMMUNICATION AS INFORMATION EXCHANGE AND TASK COHESION IN SPORT TEAMS¹

2.1 Introduction

There is general acceptance that perceived cohesiveness in sport teams is positively associated with both individual outcomes such as member adherence (e.g., Spink, Wilson, & Odnokon, 2010) and group outcomes such as team success (e.g., Carron, Colman, et al., 2002). Given its association with these key outcomes, understanding team processes that contribute to perceptions of cohesion is a first step toward offering researchers and practitioners some direction in terms of altering this essential group construct.

Sport team cohesion has been defined as "...the tendency for a group to stick together and remain united in pursuit of its instrumental objectives and/or for the satisfaction of member affective needs" (Carron et al., 1998, p. 218). While this definition clarifies the meaning of the construct, understanding the cues or sources of information that individuals use to formulate their perceptions of cohesiveness is equally important (Spink, McLaren, & Ulvick, in press). As noted elsewhere (McLaren & Spink, 2018), one potential cue within the group that may serve as a salient antecedent of group cohesion is the communication that takes place between group members. The general purpose of this research was to test whether the process of member communication in sport acts as a potential cue for perceived group cohesion.

Examination of the association between member communication and cohesion perceptions has intuitive appeal given the importance placed on this team process in seminal works in the group dynamics area (e.g., Cartwright, 1968, McGrath, 1984). McGrath (1984) contended that communication was a fundamental process that separated a group from a mere collection of individuals. In addition, member interactions have been highlighted as a unit of analysis in groups (structural) that fall between the individual and group level that might be a source of information for perceptions of cohesion (Cattell, 1948). Member interactions also are reflected in teambuilding models for cohesion (Carron & Spink, 1993) where communication

¹ This manuscript has been accepted for publication (citation follows). The manuscript formatting has been adjusted from the accepted article to meet dissertation formatting requirements. Appendix references have been added. The reference section has been removed and amalgamated into one section for the entire dissertation.

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and interaction processes are identified as a throughput by which the group environment and group structure (inputs) come to impact perceived cohesion for different activity groups. Finally, communication is identified as one teamwork process (mediator) in McEwan and Beauchamp's (2014) input-mediator-output conceptual framework for teamwork and team effectiveness. These authors suggested that team cohesion is an emergent state that arises from, among other team processes, the communication among team members.

In sport, most of the research examining communication and cohesion has been directed toward the association between social properties of member interactions and cohesion perceptions (e.g., McLaren & Spink, 2018; Smith et al., 2013; Sullivan & Short, 2011). Generally, this research supports the observations that acceptance-, distinctiveness-, and positive conflict-related communication positively predicted cohesion, whereas negative conflict-related communication negatively predicted cohesion. While identifying these relationships represent a good starting point, looking beyond the specific social properties of the interactions could further inform our understanding of communication as a potential predictor of perceived cohesion in sport.

Consistent with this suggestion, Sullivan and Short (2011) recognize that their sport measure of communication—as assessed through the SECTS-2—uses a social lens, and that member communication also could be considered for its functional properties (i.e., information exchange; Eccles and Tenenbaum, 2004). Taking this perspective also coheres with a common underlying belief espoused by some theoreticians (e.g., DeChurch & Mesmer-Magnus, 2010; Hinsz et al., 1997) that all task-based groups are, at some level, information-processing units. In essence, could a focus on communication in terms of how information is exchanged between members contribute to our current understanding of how the critical team process of communication relates to whether the team is perceived to be cohesive?

The rationale for examining information exchange can be traced back to early group dynamics theorizing. Cartwright (1968) noted that individual group members are more likely to perceive cohesiveness if the incentive properties of the group complement a motive base for membership. As one example, member similarity may serve as an incentive property of the group. Evidence exists that when members evaluate objects in their environment more similarly (e.g., Newcomb, 1953), and possess an understanding of the contributions that one member can make to another (e.g., Gross, 1956), cohesion is enhanced. As the perceived exchange of

information or knowledge increases, the resultant could be an increase in the perception that members are ‘all in’, which could, in turn, relate to higher perceived cohesiveness.

With respect to communication that involves the exchange of knowledge and information between group members, it follows that to make effective use of this shared information a degree of member cooperation will be required. Specific to sport teams, members have a defined set of roles and responsibilities and are interdependent, such that actions of team members depend on the actions of others. When this is coupled with the introduction of an opponent and an uncertain, dynamic competitive environment, the need to exchange new and existing information becomes critical given the assumption that both teams are working from a pre-defined game plan. Cooperative communication, as reflected in cooperation theory (Tjosvold, 1984), represents the degree to which these exchanges occur in a team environment. These member interactions take place to facilitate the joint achievement of team goals (see Lee, 1997). The secondary results from one study in sport which focused on leader-member exchange reported that cooperative communication among members positively related to cohesion in an adolescent sample (Cranmer & Myers, 2015).

In terms of cohesion, member information exchanges typically revolve around the task aspects of the group (e.g., taskwork, teamwork; Marks, Mathieu, & Zaccaro, 2001), and reference how the group integrates information as a whole. One illustrative example could be the communicative elements related to clarifying a member’s role on the team (i.e., role clarity; Cunningham & Eys, 2007). If members communicate to teammates information about the behaviours required for proper role accomplishment, this role-related information could have implications for how the team works together in pursuit of important task goals and objectives (Eys & Carron, 2001). As such, I chose to test communication as a predictor of cohesion using a measure of task cohesion that captures this bonding within the team as a whole (i.e., group integration – task; Carron et al., 1985). Viewing the exchange of information, knowledge, or resources between members should provide an athlete with an overview of the direction the team is taking toward task goals and objectives.

Taken together, group dynamics principles (e.g., Cartwright, 1968) as well as conceptual models of teambuilding (Carron & Spink, 1993) and teamwork (McEwan & Beauchamp, 2014) in sport and activity settings, highlight a direct link between the communication processes of team members and perceptions of task cohesion. However, to date, only a small body of sport

literature (Carron & Eys, 2012) exists linking the two constructs. As such, the current study was designed to continue to build the limited research base examining the communication/cohesion relationship by testing a first-generation research question (Zanna & Fazio, 1982). This involved sampling athletes from a wide variety of team sport contexts to understand how different properties of member communication relate to task cohesion.

This study had two purposes. The first was to test a basic tenet of science about the need for replication (see Zwann, Etz, Lucas, & Donnellan, *in press*). Specifically, the study was designed to replicate with variation (Locke, 2015) the relationship between the social properties of communication and perceived cohesion in a sample of adult team sport athletes. In doing so, this constructive form of replication (Huffmeier et al., 2016) would provide additional support illustrating that the relationships demonstrated in past research (e.g., McLaren & Spink, 2018; Smith et al., 2013; Sullivan & Short, 2011) are not necessarily due to an artifact or boundary condition associated with those studies (e.g., sample demographics, moderating variables). It was hypothesized that the positive dimensions of social communication properties (i.e., acceptance, distinctiveness, and positive conflict) would positively predict task cohesion, and the negative dimension (i.e., negative conflict) would negatively predict task cohesion. It also was deemed necessary to control for team performance in this replication as task cohesion perceptions have predicted team performance in past research (Benson, Siska, Eys, Priklerova, & Slepicka, 2016; Carron, Colman, et al., 2002).

The second purpose was to establish if communication conceived as information exchange would contribute unique variance beyond the different social communication properties captured in our current knowledge base in sport (e.g., McLaren & Spink, 2018; Smith et al., 2013; Sullivan & Short, 2011). While conceptual models in organizational psychology underscore the importance of member exchange of information (see Mesmer-Magnus & DeChurch, 2009 for a meta-analysis), our understanding of its relationship with cohesion in sport is very limited (e.g., Cranmer & Myers, 2015). Further, information exchange has been found to be a critical coordinating mechanism in dynamic team environments (e.g., Salas, Sims, & Burke, 2005; Silva, Garganta, Araujo, Davids, & Aguiar, 2013). Also, indirect findings revealed a positive relationship between cooperative communication and cohesion in an adolescent sport sample (Cranmer & Myers, 2015). Therefore, it was hypothesized that the presence of greater information exchange between members of a sport team would positively predict perceived task

cohesion. Further, because information exchange represents a different aspect of communication, it was reasoned that unique variance would be accounted for in task cohesion beyond the social properties of communication.

2.2 Method

2.2.1 Participants and design

A sample of team sport athletes ($N = 180$, 57% female) participated in this study. Participants had an average age of 24.9 ($SD = 7.1$ years) and reported an average of 4.0 years of experience competing on their respective sport team. Although a wide range of sport types were represented, athletes primarily competed in soccer (22%), ice hockey (17%), and volleyball (16%), and were either currently competing on their team at the time of the study (57%) or had just finished a season (within two months of the season ending). To check for possible in-season/out-of-season response differences, an initial analysis of the communication/cohesion relationships revealed the same pattern of results for those currently competing and those two months or less removed from competition. In order to maximize statistical power, the decision was made to combine all participants into one main analysis. Participants were most likely to be competing at the recreational level (53%) on same-sex teams (64%), and identified as a starting player (86%). This study employed a cross-sectional design using an online survey tool.

2.2.2 Procedure

Following University Research Ethics approval, participants were invited to complete the online survey using social media and an internal university message board (Appendix A). After providing informed consent (Appendix B), participants completed a series of questionnaires that were randomly presented to control for potential order effects (Appendix C). Participants were instructed to respond to questionnaire items while thinking either of their current team or a team they competed on recently. If participants competed on more than one team, they were instructed to choose and report only the team they most identify with, and answer all questions in reference to that team. Upon completion, participants were offered the opportunity to enter a draw for a gift card to a local restaurant as potential compensation for their time.

2.2.3 Measures

Information exchange. Exchanges were captured using the Cooperative Communication Scale (Lee, 1997) adapted for sport (Cranmer & Myers, 2015). Seven items captured the degree to which participants believed interactions within their sport team were cooperative in nature. The items focused on exchanging information, resources, and knowledge for the greater good of the team (e.g., “Relevant information is exchanged openly among team members,” “Some individuals on my team intentionally provide misleading information to other members,” “My team members openly share their ideas with other team members”). Responses were captured on a Likert-type scale anchored at 1 (*strongly disagree*) and 5 (*strongly agree*) and, after reverse-scoring negatively-worded items, higher average scores across all items indicated higher cooperative member information exchange. Initial reliability analysis revealed that item 3 (i.e., “Team members often criticize other team members”) was a poor indicator of information exchange and therefore was removed. The internal consistency of the remaining six items was .72. This was consistent with research in both work ($\alpha = .80$; Lee, 1997) and sport settings ($\alpha = .79$; Cranmer & Myers, 2015).

Intra-team communication. Athletes’ perceptions of social communication properties were measured using the Revised Scale for Effective Communication in Team Sport (SECTS-2; Sullivan & Short, 2011). Items in the SECTS-2 were introduced with the stem “When our team communicates, we...”. Four dimensions of intra-team communication were measured: acceptance (4 items; $\alpha = .79$; e.g., “...try to make sure all players are included”), distinctiveness (3 items; $\alpha = .76$; e.g., “...use nicknames”), positive conflict (4 items; $\alpha = .77$; e.g., “...get all problems out in the open), and negative conflict (4 items; $\alpha = .85$; e.g., “...show that we lose our temper”). The alpha values reported above represent data from the current study. Athletes indicated how often the members of their team communicated according to each item on a 7-point Likert-type scale anchored at 1 (*hardly ever*) and 7 (*almost always*). Higher average scores across items within each dimension reflected a higher presence of each social property among team members. The SECTS-2 has demonstrated reliability and validity in past research (Sullivan & Short, 2011).

Task cohesion. Perceptions of task cohesion were measured using one subscale (Group Integration- Task; GI-T) from the Group Environment Questionnaire (GEQ; Carron et al., 1985) using the positive wording version (see Eys, Carron, Bray, & Brawley, 2007). Five items captured this subscale (e.g., “Our team is united in trying to reach its goals for performance”).

Items were rated on a 9-point Likert-type scale. Higher average scores across all items reflected higher task cohesion perceptions. Reliability analysis revealed that the scale was internally consistent ($\alpha = .85$) and comparable with past research (e.g., $\alpha = .70-.84$; Eys et al., 2007).

Team performance. With a range of athletes from different sport types, it was necessary to assess and control for team performance using a subjective rating. This was done to control for potential differences in the various objective ratings of performance that could arise across different sport types (e.g., some sports include tie games in standings, some do not). As such, participants were asked to indicate how many games the team they reported would typically win using a 7-point Likert-type scale anchored at 1 (*wins very few games*) and 7 (*wins most games*). Higher scores reflected higher self-reported team performance vis-à-vis winning games.

2.2.4 Data analysis

Prior to the main analysis, data were screened for univariate and multivariate normality, multicollinearity, homoscedasticity, and common method variance. To address the study hypotheses, a hierarchical multiple regression was used to examine if member communication through a social and functional lens served as predictors of task cohesion (GI-T). To control for team performance, self-reported typical performance was entered at step 1, while perceptions of social communication properties (acceptance, distinctiveness, positive conflict, and negative conflict) were entered at step 2, with communication as information exchange entered at step 3. To determine the degree to which the different communication variables uniquely predicted task cohesion perceptions, semi-partial correlations were examined in the final model.

2.3 Results

2.3.1 Descriptive statistics

Testing for the assumptions of multiple regression analysis led to the removal of two participants owing to univariate, and two participants owing to multivariate outliers ($z > 3.0$). As a result, 176 participants were eligible for the main analysis. In terms of normality, GI-T demonstrated a departure from normality via negative skew. Therefore, a log transformation was applied to correct for this departure. However, a subsequent analysis revealed that the results were the same for raw and transformed values, so raw scores were retained for ease of interpretation. Descriptive statistics are provided in Table 2.1.

Table 2.1

Study 1 Descriptive Statistics for Team Performance, Communication, and Cohesion

Variable	Mean	SD	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Team performance ¹	5.03	1.53	--	.21*	.10	.25*	-.12	.23*	.30*
(2) Acceptance ²	5.50	1.03		--	.15	.81*	-.34*	.69*	.69*
(3) Distinctiveness ²	4.39	1.65			--	.20*	-.38*	.03	.31*
(4) Positive conflict ²	4.87	1.11				--	-.17*	.62*	.61*
(5) Negative conflict ²	3.08	1.40					--	-.37*	-.23*
(6) Information exchange ³	4.26	.48						--	.60*
(7) Task cohesion (GI-T) ⁴	6.88	1.48							--

Note: Correlations between study variables are found above the diagonal. * $p < .01$. ¹ Team performance and ²intra-team communication dimensions were measured on a 7-point scale, information exchange³ on a 5-point scale, and task cohesion⁴ on a 9-point scale. Acceptance communication was removed from the main analysis due to multicollinearity concerns.

Further, multicollinearity was present in that acceptance communication demonstrated a high degree of overlap with positive conflict, and to a lesser degree with information exchange communication (see Table 2.1 for correlations). As such, a decision was made to remove this communication type from further analyses to reduce redundancy in the regression equation and avoid the artificial inflation of standard errors (Tabachnick & Fidell, 2013).²

Finally, given that these data were gathered from a common methodological source (i.e., Likert-type perceptual rating scales) at a single time-point, screening for the presence of common method variance was conducted. Results from exploratory- (i.e., Harman's one-factor test) and confirmatory-based analyses (i.e., common latent factor) revealed minimal influence of a common method bias within these observed data. Specifically, just 30% of the variance between the items was accounted for in the Harman's one-factor test, and the inclusion of a common latent factor in a confirmatory factor analysis did not change the standardized factor loadings

² Of note, I also examined the communication/cohesion relationships substituting acceptance for positive conflict and found the same pattern of relationships.

among the items (see Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). As such, it appears as if common method variance did not play a large role in the responses collected across the different measures.

2.3.2 Multiple regression

A hierarchical multiple regression was used to predict task cohesion (GI-T) from perceptions of social and functional communication properties, while controlling for team performance. On step 1, as expected the control variable of team performance was a significant predictor of task cohesion, $F(1, 174) = 17.23, p < .001$, accounting for 9% of the overall variance. On step 2, the addition of the three social properties of member communication contributed an additional 37% of the variance in task cohesion, $F_{\text{change}}(3, 171) = 41.49, p < .001$. Based on the standardized estimates, team performance remained a significant predictor, ($\beta = .12, sr = .12$), and each of distinctiveness ($\beta = .29, sr = .26$), positive conflict ($\beta = .48, sr = .44$), and negative conflict ($\beta = -.25, sr = -.22$) communication significantly predicted task cohesion in the expected directions. On step 3, the inclusion of information exchange communication added significantly to the model, $F_{\text{change}}(1, 170) = 20.48, p < .001$, contributing an additional 6% to the overall variance in task cohesion. Overall, the final regression model significantly predicted task cohesion, $F(5, 170) = 38.34, p < .001$, accounting for 52% of the variance.

An inspection of the standardized estimates within the final regression model revealed that social properties of communication in the form of distinctiveness ($\beta = .29, sr = .25$) and positive conflict ($\beta = .30, sr = .23$) as well as information exchange ($\beta = .32, sr = .24$) were significantly related to GI-T perceptions (all $ps < .001$). Team performance was not ($p = .07$). As revealed by the semi-partial correlations, each of the communication dimensions contributed unique and comparable variance in GI-T when the other dimensions were held constant. In the expected direction with previous research (Sullivan & Short, 2011), negative conflict communication also was a significant predictor of GI-T ($\beta = -.16, sr = -.13, p = .01$) but had less unique predictive utility. A full summary of the hierarchical regression analysis results can be found in Table 2.2.

Table 2.2

Member Communication Predicting Task Cohesion While Controlling for Team Performance

Variable	R^2_{adjusted}	F (degrees of freedom)	β	sr	t
<i>DV: Task cohesion (GI-T)</i>					
Step 1:	.09	17.23*** (1, 174)			
Team performance			.30	.30	4.15***
Step 2:	.46	38.43*** (4, 171)			
Team performance			.12	.12	2.15*
Distinctiveness			.29	.26	4.68***
Positive conflict			.47	.44	7.97***
Negative conflict			-.25	-.22	-3.97***
Step 3:	.52	38.34*** (5, 170)			
Team performance			.11	.10	1.92
Distinctiveness			.29	.25	4.80***
Positive conflict			.30	.23	4.32***
Negative conflict			-.16	-.13	-2.54*
Information exchange			.32	.24	4.53***

Note: * $p < .05$, ** $p < .01$, *** $p < .001$. sr is the semi-partial correlation between each predictor and the dependent variable.

2.4 Discussion

It is well established that group cohesion is an important construct in the context of team sport. Although the antecedents are not as well understood as the consequences of cohesion (Carron & Eys, 2012), communication is one variable that has long been suggested as a source of information related to forming perceptions of cohesion (e.g., Cartwright, 1968). Building on recent evidence reporting that the social properties of communication between members is

related to perceived cohesiveness in sport (e.g., McLaren & Spink, 2018), the current study sought to both replicate and extend this finding. Specifically, the current study tested whether communication operationalized as information exchange also would be related to perceptions of cohesiveness.

In support of team member communication, study results suggested that communication appeared to be associated with task cohesion perceptions both from a social and functional perspective. The current study replicated past research in finding that distinctiveness and positive conflict communication were positively associated with task cohesion while negative conflict communication was negatively associated with task cohesion (e.g., McLaren & Spink, 2018). Due to multicollinearity concerns, acceptance was not tested.

By conducting this study with a different sample and controlling for the variance accounted for by team performance, this replication with variation (Locke, 2015) broadened the bounds of the communication/cohesion relationship in the team sport context (i.e., constructive replication; Huffmeier et al., 2016). These empirical findings are in line with conceptual frameworks in sport signaling that communication between members may be related to cohesion perceptions (e.g., Carron & Spink, 1993; McEwan & Beauchamp, 2014). Further, the finding that the social communication property accounts for a comparable amount of overall variance in task cohesion when considered together with team performance (i.e., 46% in this study at step 2) versus when team performance is not considered in other studies (i.e., 40% without team performance; McLaren & Spink, 2018) refines our understanding in that the variance accounted for was similar. This underscores the importance of the social properties of member communication as a strong predictor of task cohesion over and above self-reported team performance.

To date, the limited body of literature examining communication and cohesion in sport (e.g., McLaren & Spink, 2018; Smith et al., 2013; Sullivan & Short, 2011) has focused primarily on the social aspects of communication while not considering the functional underpinnings of this process. Thus, a second purpose of this study was to widen our understanding of member communication in sport by also considering communication as a form of information exchange. Relevant to this purpose, the results of this study supported the hypothesis that higher perceived information exchange would be related to higher perceptions of task cohesion (GI-T) independent of the social properties of communication and team performance perceptions. When

athletes perceived that the members of their sport team engaged in a greater quantity of cooperative open information exchanges, they also reported perceiving greater cohesiveness in relation to the task goals and objectives of the team. In Cranmer and Myers' (2015) study on leader-member exchange in a sport setting, a comparable significant relationship between communication as information exchange and perceptions of task cohesion also was reported.

The current results build upon, and extend past research (e.g., McLaren & Spink, 2018; Smith et al., 2013; Sullivan & Short, 2011). Specifically, the current finding highlights that while the social properties of communication between sport team athletes predict task cohesion perceptions, communication as information exchange also made a unique contribution. More specifically, this contribution is beyond the variance accounted for by both team performance and social properties, adding credence to the relevance of information exchange as an important property of communication in the prediction of the team aspect of cohesion.

A strength of this study was the use of general group dynamics principles and sport/activity models to provide a more detailed picture of the communication/cohesion relationship. For instance, group dynamics principles as noted by Cartwright (1968) highlight communication patterns as an incentive property drawing members to a group (i.e., increased cohesion), but do not necessarily identify how this might happen. The current findings shed light into the aspects of communication by suggesting that social and functional properties of communication together may provide an athlete with a perception that members are united in pursuit of task goals and objectives. The findings also validate conceptual models in sport (McEwan & Beauchamp, 2014) and activity settings (Carron & Spink, 1993) that link communication processes to the emergence of cohesion perceptions.

In addition to these strengths, it is important to recognize possible limitations. First, team performance was measured using a single self-report item designed specifically for this study, which does not allow for the calculation of reliability or validity estimates. Further, another potential issue with using self-report to generate a group-level variable (i.e., team performance) is the opportunity for bias to feature in this rating (e.g., self-presentation due to status), which may not be present in an objective rating of actual performance attainment. However, the single item was deemed acceptable as this was a first-generation research question and team performance only served as a control variable.

In terms of generalizability, the participants were comprised primarily of participants on teams of higher interdependence (e.g., soccer, volleyball, ice hockey). One future direction might be to examine individuals participating on teams of lower interdependence (e.g., baseball, wrestling; Evans et al., 2012). It would be interesting to establish if member information exchanges are associated with task cohesion in the same way for teams of low interdependence, where less member interaction/exchange is required to perform team tasks. Also, by combining all sport types to increase statistical power, another limitation is the loss of resolution in generalizability by not being able to provide greater detail across each of the sport types that were combined.

In addition, the current study was focused on continuing to examine the basic relationships between communication and cohesion. As such, the decision was made to use measurement tools that relied on individual perceptions in order to maximize the possible sample. While not found to be problematic in the current study, the fact remains that common method bias may have accounted for some of the observed relationship between communication and task cohesion (Podsakoff et al., 2003).

Although the complete removal of common method bias is not possible in a study design such as this one, Podsakoff and colleagues (2003) suggest remedies for reducing the potential impact of the bias—one of which is to obtain different measures of the predictor and criterion variables. In order to address this possible limitation, one suggestion would be to use social network analysis to understand team communication patterns using dyad-based data (i.e., communication between two individuals) (Bourbousson, R'Kiouak, & Eccles, 2015; Wildman, Salas, & Scott, 2014). In social network analysis, the objective is to explicitly demonstrate which team members are socially tied (e.g., those who interact; Borgatti & Cross, 2003). This methodological advancement also would be in line with the idea of structural properties (as formed by member interactions) acting as an incentive property for cohesion (Cartwright, 1968).

Also, it is worth noting that while any speculation may have implied directionality, the cross-sectional design does not allow for causality claims. Whereas the suggestion that communication may be potential cue for task cohesion was grounded in existing activity/sport models (Carron & Spink, 1993; McEwan & Beauchamp, 2014), it is possible that task cohesion could be a cue for communication. Future research using experimental and prospective designs is needed to address the question of directionality.

In summary, the results provide further evidence (constructive replication; Huffmeier et al., 2016) that social properties of communication are strongly predictive of task cohesion perceptions. Interestingly, this finding emerged regardless of whether the athlete competed on a more or less successful team (i.e., by controlling for team performance). However, this initial evidence is a first step in testing the relationship between communication as information exchange and perceived task cohesion. Replication using different study designs would provide further evidence for the information exchange/task cohesion relationship identified in this study.

2.5 Bridge to Studies 2 and 3

The results of Study 1 offered preliminary evidence that information exchange was positively associated with task cohesion when controlling for both team performance and the previously recognized social properties of communication. However, one limitation of this study was the focus on individual perceptions for information exchange behaviours. The purpose of Studies 2 and 3 together was to model the specific connections between members who communicate and extend the findings of the first study to consider both the way individuals exchange information as well as how the team as a whole engages in information exchange.

CHAPTER 3

STUDIES 2 AND 3: MEMBER COMMUNICATION AS NETWORK STRUCTURE: RELATIONSHIPS WITH TASK COHESION IN SPORT

3.1 Introduction

Over the years, cohesive sport teams have been associated with important outcomes for the team (e.g., higher team performance; Carron, Colman et al., 2002) as well as the individual (e.g., adherence to the team; Spink et al., 2010). Further, more recent research has reported positive relationships between group cohesion and less traditional sport outcomes such as role perceptions (Benson et al., 2016) and social identity perceptions (e.g., Rees, Haslam, Coffee, & Lavalley, 2015).

While research examining these varying outcomes of cohesion is important, less attention has been paid to the identification of potential cues that might serve as sources of information as to the degree that a team is in fact cohesive (e.g., Spink et al., in press). It has been proposed that communication patterns between team members may serve as one potential cue informing cohesion (McLaren & Spink, 2018). This speculation is not without precedent as using communication to inform team cohesion aligns with early group dynamics theorizing (e.g., Cartwright, 1968; McGrath, 1984; Shaw, 1964). According to Cartwright (1968), individuals will consider a number of different elements within the group before considering the degree to which their group is cohesive, including the different incentive properties of the group. One such incentive concerns the group's structural component, which comes about because of member communication (e.g., Shaw, 1964).

To date, the small body of extant communication/cohesion sport literature has been derived from examining the perceived social communication properties (i.e., acceptance, distinctiveness, positive conflict, and negative conflict) that occur between members (e.g., Kim et al., 2016; McLaren & Spink, 2018; Sullivan & Short, 2011). Further, it was found in Study 1 that higher perceived information exchange between members was associated with unique variance in task cohesion over and above the established social communication properties noted above.

However, by only gathering communication data through individual perception, the ability to tie these findings to group structure vis-à-vis member communication is limited. For instance, when an athlete reports the degree to which different aspects of communication occur

between the members of his/her respective team, it is not possible to discern exactly who that athlete is referencing. Is it the team as a whole, his/her own interactions, or some combination of both? The ability to answer this question is important if one is interested in examining communication as a potential cue for cohesion. Carron and colleagues (Carron & Brawley, 2000; Carron, et al., 1998) make it clear that a member's assessment of team cohesion comes in part from an individual experiencing the social situation within the team as well as the actual reality of the team as a whole. Given this understanding, it would follow that the examination of communication along similar lines (e.g., member communication with other members *and* the overall pattern of communication among all group members) would provide a more complete picture of the communication/task cohesion relationship. The assumption being that there is awareness of the latter (i.e., the overall team communication patterns) by each individual.

3.1.1 Social Network Analysis

One suggestion to address this individual/team interface involves the use of a dyad-based measurement tool (e.g., Lusher, Robins, & Kremer, 2010) such as social network analysis (Borgatti et al., 2013). Social network analysis is the study of social relations among a defined set of actors such as the members of a sport team (Borgatti et al., 2013), and is of value for sport communication research. This is because the others with whom a member communicates (e.g., information exchange) can be identified (Ishak, 2017) as well as the overall communication network structure can be analyzed. Social network analysis makes this possible because communication can be examined from two unique perspectives that capture both one member's communication with other members (ego network) and the overall pattern of communication among all members of a defined group (whole network).

Ego and whole networks. In the case of an ego network, the network of a specific athlete can be isolated to examine the team members with whom that member (the ego) engages in information exchange. In predicting task cohesion, the value of this network lies in the establishment of specific information exchange behaviours from the perspective of the athlete. In this way, researchers can test if task cohesion perceptions differ as a function of the proportion of teammates with whom a specific member exchanged information. Second, all members of a specific group can be considered together in the form of a whole network. This allows for the information exchange of the team as a whole to be examined as opposed to the exchanges involving just one specific member.

Considering communication network structure, Shaw (1964) argued that if individuals belong to a team in which the network structure is characterized by a larger proportion of connections between a larger proportion of members, the group is seen as more attractive by the individual member. If this attractiveness can be assumed, this should translate into members wanting to remain united in the pursuit of important team goals (i.e., higher task cohesion). There are a number of social network metrics (relevant to ego and whole networks) that are relevant for testing this suggestion (Borgatti et al., 2013).

Social network metrics. From an ego network perspective, the centrality of each individual within the team can be calculated in two ways based on the degree to which that member is central in the network. Specifically, the proportion of group members with whom an individual communicates is known as outdegree centrality, while the proportion of group members who communicate with that same member is known as indegree centrality. It is assumed that the more central a member is in a communication network (based on the number of outdegree and indegree nominations) the larger the role they play in the flow of communication.

In terms of the whole network perspective, centrality metrics also can apply to the group as a whole. In modeling the overall communication network, those with the higher individual degree centrality will be at the center (core) of the network, and those with lower individual degree centrality will be in the outer portions of the network (periphery). According to Shaw (1964), groups with more core members would be a decentralized network that would reflect more members responsible for information exchange flow.

The metric of network density captures the combination of all individual degree centrality scores to model the team network as a whole. Network density is the reported number of information exchanges between members as a proportion of the total number possible (range from 0-1). An increase in network density signifies that the team as a whole is engaging in higher information exchange. Fewer connections between members of a team will reduce the density of the network and could create the presence of structural holes that could limit the flow of information between members. If some of the team members refrained from information exchange, this may signal to an individual member that the team lacks unity in the pursuit of team task goals and objectives (i.e., lower task cohesion).

The purpose of the current research was to examine the relationship between information exchange network structure and cohesion. While past research based on individual perceptions

supports this position generally (e.g., Study 1), these results have been unable to speak to the communication contributions associated with the perspective of the individual and the team. As such, testing how the individual members of a team exchange information and how the team exchanges information as a whole may offer greater clarity about the communication/task cohesion relationship. Given that information exchange often pertains to the task-related aspects in the sport team (versus the social; Carron et al., 1985), task cohesion was the focus.

Keeping with the preliminary nature of these research questions, two studies were conducted using different research designs. Study 2 focused on the individual (ego) networks of a large field sample of athletes currently competing on intact sport teams. This was an important first step when it comes to building on past findings of the communication/cohesion relationship (e.g., Kim et al., 2016; McLaren & Spink, 2018; Sullivan & Short, 2011) because individual ego networks are the component parts of a whole network.

While the focus in Study 2 was on ego networks, in Study 3, the communication structure was expanded to the whole network level. In doing so, the individual ego network findings of Study 2 could be extended to also include the density of the network structure as a whole. This third study complements the second in that task cohesion perceptions can be tested against the degree to which members exchanged information combined with the cumulative exchange behaviours of the team as a whole.

3.2 Study 2

3.2.1 Introduction

A team communication network in which members are well connected (higher individual degree centrality) has been identified as a structural aspect of the group that could serve as an incentive property for members to remain (i.e., determinant of cohesiveness; Cartwright, 1968; Shaw, 1964). The purpose of Study 2 was to focus specifically on the connectedness of individual members within the context of their sport team. This study was designed to test if higher perceptions of cohesion are characteristic of those athletes who exchanged information with the largest proportion of their teammates via an ego network analysis. This direction is consistent with preliminary empirical research based on perceptions of information exchange (e.g., Cranmer & Myers, 2015).

Individual ego networks (Borgatti et al., 2013) were used to determine if perceptions of task cohesion differed between those who reported a larger, moderate, or smaller sized ego

information exchange network in terms of outdegree centrality (i.e., number of members with whom an individual exchanged information). Returning to assessments of team cohesiveness (e.g., Carron & Brawley, 2000), it has been argued that athletes generate an approximation of the degree to which the team is united in pursuit of task goals and objectives (i.e., task cohesion) based on his/her individual experiences within the team. By exchanging information during the game with many others, this may signify to a member that teammates are ‘in it together’ in pursuing these task goals. Conversely, if members exchange with few others, this may indicate a lack of cohesiveness as it may appear that not all members are united in this same pursuit.

As a replication of preliminary research (Study 1) using a different method (i.e., social network analysis), it was hypothesized that perceived task cohesion would increase as the information exchange network grew in size (i.e., network size-cohesion relationship). To do this, three groups of athletes were compared based on the size of their network (i.e., larger, moderate, and smaller size). It was expected that athletes with a larger proportion of teammates in their information exchange ego network would perceive the team to be higher in task cohesion compared with those athletes with a moderate sized ego network. In addition, the athletes with a moderate sized network would perceive higher task cohesion than those with a smaller ego network size.

3.2.2 Method

3.2.2.1 Participants

A sample of basketball athletes ($N = 205$, 36% female) from two adult sport leagues (male and female) were recruited to participate in this study. Participants had an average age of 28.6 ($SD = 6.2$ years), with the majority of athletes (i.e., 55.1%) between the ages of 22 and 29 years (range 18 - 50). Participants reported an average of 3.6 years of experience competing with their current team, and 17.3 years in basketball overall. In terms of status, 156 (76.1%) athletes self-identified as a starter, with athletes playing a range of positions on the court.

In terms of the more general league demographics, the men’s league had six divisions (five with teams involved in the study, $k = 27$) and the women’s league had four divisions (three with teams involved in the study, $k = 12$)³. The average size of the participant’s team was 10.6

³ These data were screened for potential sex differences in the information exchange network size/cohesion relationship. Given that the pattern of ANOVA results were the same across the male and female portion of the sample, the data from males and females were collapsed.

members, and participants attended an average of 75.0% of regular season league games. In total, participants reported an average of 6.6 years of experience competing in their respective league.

3.2.2.2 Procedure

Following University Research Ethics approval, I contacted team representatives to explain the objectives of the research (Appendix D) and ask for permission to recruit team members at a weekly game (Appendix E). After providing informed consent (Appendix F), participants completed a single questionnaire package in a quiet area following a game (Appendix G). It was made clear that participants could ask for clarification, refrain from answering questions they were uncomfortable with, and cease participation at any time without consequence. Participants also were asked to refrain from communicating with one another during this process. Participants were offered the opportunity to enter a gift card draw to a local restaurant as a potential compensation for their time.

3.2.2.3 Measures

Information exchange. To measure information exchange, participants were asked to create an individual (ego) network comprised of those with whom they exchange information during games. First, participants were presented with a list of the members on their basketball team roster and were asked to consider the members with whom they *regularly* exchanged information during games. They were then presented with the item “I openly exchange information with these team members,” and asked to place a checkmark next to the name of each player that applied to the statement. The number of teammates identified by the participant were tallied and converted to a proportion of the total possible teammates that could have been identified (i.e., $n - 1$, as members did not select themselves). This value reflected individual outdegree centrality. Higher values reflected a well-connected member who exchanged information with a higher proportion of teammates on a regular basis. The item used was adapted from Lee (1997).

Task cohesion. Perceptions of task cohesion were measured using the same instrument as Study 1. The GI-T scale in this study demonstrated acceptable internal consistency ($\alpha = .81$).

3.2.2.4 Data analysis

Prior to the main analysis, data were screened for outliers and multivariate normality. Given that the research question sought to compare those who engaged in information exchange with a larger, moderate, or smaller proportion of teammates (i.e., different sizes of ego networks)

and their perceived task cohesion (GI-T), a one-way analysis of variance was used. To create the ego communication network size a proportional score was calculated by dividing the number of teammates with whom a member exchanged information by the total number of possible teammates (i.e., individual outdegree centrality). The resulting proportions were divided into larger, moderate, and smaller categories based on a tertiary split of the participant scores. Although a tertiary split may have the potential to be problematic in statistical analyses (e.g., reduction in power; Cohen, 1983), it was deemed suitable for the first-generation research questions posed in this study.

As a result of the tertiary split, the larger proportion group ($n = 82$) was represented by those participants who exchanged information with all other teammates, the moderate proportion group ($n = 60$) by those with an ego network size between 67% and 99%, and the smaller proportion group ($n = 63$) by those with an ego network size less than 67%. This grouping variable was then entered as the independent variable (see Table 3.1 for descriptive statistics across network size groupings).

Table 3.1

Study 2 Descriptive Statistics across Ego Network Sizes

		Information Exchange Ego Network Size	GI-T Perceptions
Larger Ego Network ($n = 82$)	<i>Mean</i>	1.00	8.14
	<i>SD</i>	.00	.73
Moderate Ego Network ($n = 59$)	<i>Mean</i>	.79	7.63
	<i>SD</i>	.08	1.03
Smaller Ego Network ($n = 59$)	<i>Mean</i>	.40	7.18
	<i>SD</i>	.15	1.05

Note: Information exchange ego network size was measured as a proportion of the identified compared against the total possible teammates an athlete regularly exchanged information with during games (range 0-1). GI-T perceptions were measured on a 9-point scale.

3.2.3 Results

3.2.3.1 Descriptive statistics

Testing for assumptions of the one-way analysis of variance led to the removal of five participants owing to univariate outliers. As such, the final analysis was run with 200 participants ($n_{\text{larger}} = 82$, $n_{\text{moderate}} = 59$, $n_{\text{smaller}} = 59$). In terms of normality, GI-T demonstrated a departure from normality via negative skew (Skewness < -1.0). Therefore, a transformation (reflection and base-10 logarithm) was applied to correct for this departure. However, subsequent analysis revealed that the results were the same for raw and transformed values, so raw scores were retained for ease of interpretation (Tabachnick & Fidell, 2013). The assumption of independence and homoscedasticity also were satisfied ($p = .16$). Given that cell sizes were unequal, a Games-Howell correction was used post-hoc (Field, 2013).

3.2.3.2 Main analysis

To test the Study 2 hypothesis, membership in larger, moderate, and smaller ego communication network size groupings was entered as the independent variable with GI-T as the dependent variable. Overall, the group effect was significant, $F(2, 197) = 18.84$, $p < .001$, partial $\eta^2 = .16$. Post-hoc analyses with a Games-Howell correction revealed that those participants with a larger ego communication network size perceived significantly greater task cohesion (GI-T) ($M = 8.14$, $SD = .73$) compared with those who had a moderate ego communication network size ($M = 7.63$, $SD = 1.03$, $p = .05$; Cohen's $d = .64$). Further, those athletes with a moderate sized network perceived significantly greater task cohesion (GI-T) ($M = 7.63$, $SD = 1.03$) than those with a lower ego communication network size ($M = 7.18$, $SD = 1.05$; $p = .004$; Cohen's $d = .43$). According to Cohen's (1969) effect size recommendations, these differences were small-medium in terms of magnitude. Finally, a comparison between the larger and smaller ego networks revealed that the higher ego network size had significantly greater GI-T perceptions than the lower ego network size ($p < .001$; Cohen's $d = 1.17$), which would be considered a large effect based on Cohen's (1969) effect size recommendations.

3.2.4 Discussion

The results of Study 2 provided evidence to suggest that members who exchanged information with a larger proportion of their teammates on a regular basis (larger-sized network) were significantly different from those with moderate- and smaller-sized exchange communication networks in terms of their perceptions of task cohesion. Relevant to the

conceptualization of sport group cohesion, these specific experiences of the individual (i.e., personal information exchange) within the context of the team may represent one source of information that athletes use as a potential cue to form cohesion perceptions (Carron & Brawley, 2000; Carron, Brawley, et al., 2002). In this study, a network size-cohesion relationship appeared to exist in that perceived task cohesion increased as the size of the member's information communication network also increased from smaller to moderate to larger.

3.3 Study 3

3.3.1 Introduction

To extend the findings from Study 2, individual- and team-level aspects of information exchange networks were used to test for relationships with perceived task cohesion. In doing so, Carron and Brawley's (2000) contention that assessments of cohesion are made in part both by individual experiences in the group (Study 2) and the actual reality of the team as a whole can be tested (i.e., the degree to which all members are engaging in information exchange). Together, the individual and team level aspects of the network should provide a more complete picture of the relationship between communication and task cohesion perceptions.

Given its preliminary nature, this study used hypothetical vignettes to craft whole team information exchange networks that varied in the proportion of information exchange of individual members (individual degree centrality) and the team as a whole (network density) (see Mehra et al., 2014 for the use of hypothetical social network vignettes in behavioural research). Based on the results from Study 2, it was hypothesized that participants exposed to an information exchange network described with higher individual degree centrality and higher network density would report higher task cohesion compared with a network structure of lower individual degree centrality and lower network density. A communication network structure with higher individual degree centrality and network density would reflect individual members engaging in information exchange with a larger proportion of teammates and the team engaging in higher information exchange as a whole.

3.3.2 Method

3.3.2.1 Participants and design

A sample of team sport athletes ($N = 177$, 52% female) were recruited to participate in this study. Participants were eligible if they had been a member of a sport team (and identified that sport type) within the past year up to, and including, those currently competing on a team

(72%). Overall, participants had an average age of 23.8 ($SD = 7.5$ years) and reported an average of 10.5 years of experience competing in their respective sport. Participants identified soccer, ice hockey, and volleyball as the most common sport types, with 57% of participants competing at the competitive level. The average team size was 14.9 members. To test study hypotheses, a between-subjects design with random assignment using an online survey tool was used.

3.3.2.2 Procedure

Following University Research Ethics approval, participants were invited to complete the online survey using social media and an internal University message board (Appendix H). After providing informed consent (Appendix I), participants were instructed that they would be presented with a team communication network image, and that they were to imagine what it would be like to be a member competing on this team (Appendix J). Participants were assigned randomly to view one of two network images portraying a team communication network (i.e., between-subjects design).

Team descriptions. Two hypothetical vignettes were used in this study to form whole networks that varied in structure because of member information exchange. The network descriptions used in this study were crafted to align not only with the operationalization of exchanges from Study 2, but also group dynamics principles generally (e.g., Cartwright, 1968).

A pilot study also was conducted to determine if the hypothetical sport teams described with varying levels of member exchanges would be perceived to differ in terms of network density and individual degree centrality. To do this, a different sample of athletes ($N = 152$) were presented with a series of networks that increased in individual degree centrality and network density (see Brands, Menges, & Kilduff, 2015, Study 3). They were asked to select the specific centrality- and density-focused network that best captured the described team (i.e., higher or lower proportion of information exchanges between members) (see Appendix K, L). As predicted, those who read about the higher information exchange team description ($n = 75$) identified a network that was significantly higher in individual degree centrality and network density than the team network crafted to be lower in information exchange ($n = 77$), $p < .001$.

Based on the corresponding literature and results of the pilot study, the network vignettes were created to adequately capture the essence of member exchanges in enough detail to maximize internal validity and control for external influence (e.g., ambiguity; see Hox, Kreft, & Hermkens, 1991). As noted above, two extreme network groups were purposefully fashioned to

create controlled conditions under which the relationship between information exchange networks and task cohesion could be examined. Specifically, one team engaged in a larger proportion of information exchange such that individual degree centrality and network density were higher, and more members were in the core versus the periphery of the network. The corresponding network graphic created for this team had an overall network density of .75, which equated to an average member exchanging information with 75% of other team members. The other team engaged in fewer exchanges such that individual degree centrality and network density were lower, and more members were in the periphery versus the core of the network. This team network graphic had an overall network density of .25 meaning that the average member exchanged information with 25% of other teammates.

In the preamble to the manipulated portion of the vignettes, participants were instructed that they would be reading a description of a team and would be shown a graphic that matched that description. In terms of the network graphic, participants were first instructed to think of each member of the team depicted in the image as a small square, and the lines connecting those squares as representative of the team members who exchanged information on a regular basis. Thick lines denoted reciprocal interactions and thin lines represented unidirectional interactions. Participants were asked to consider how individual members on that team engaged in information exchange based on the number of lines connected to each member (individual degree centrality) and the overall network of all members exchanging information (network density).

On the following page, participants then were randomly exposed to one of two vignettes. As noted, these vignettes had two parts—a written description of the manipulated individual degree centrality and network density of the team followed by a corresponding network image. In the written portion, the type of sport team the participant had reported previously was transferred into the vignettes by the survey software. For instance, the vignette for an individual who reported playing on a volleyball team would start with “The members of this volleyball team... .” The written passage of each vignette can be found in Appendix K (see also Figure 3.1 for corresponding network images). Following this manipulated portion of the hypothetical team vignettes, it was stated in both descriptions that the network of teammate communications had emerged as a result of the experiences of the team early in the competitive season. Participants were asked to imagine themselves as a member of the described team.

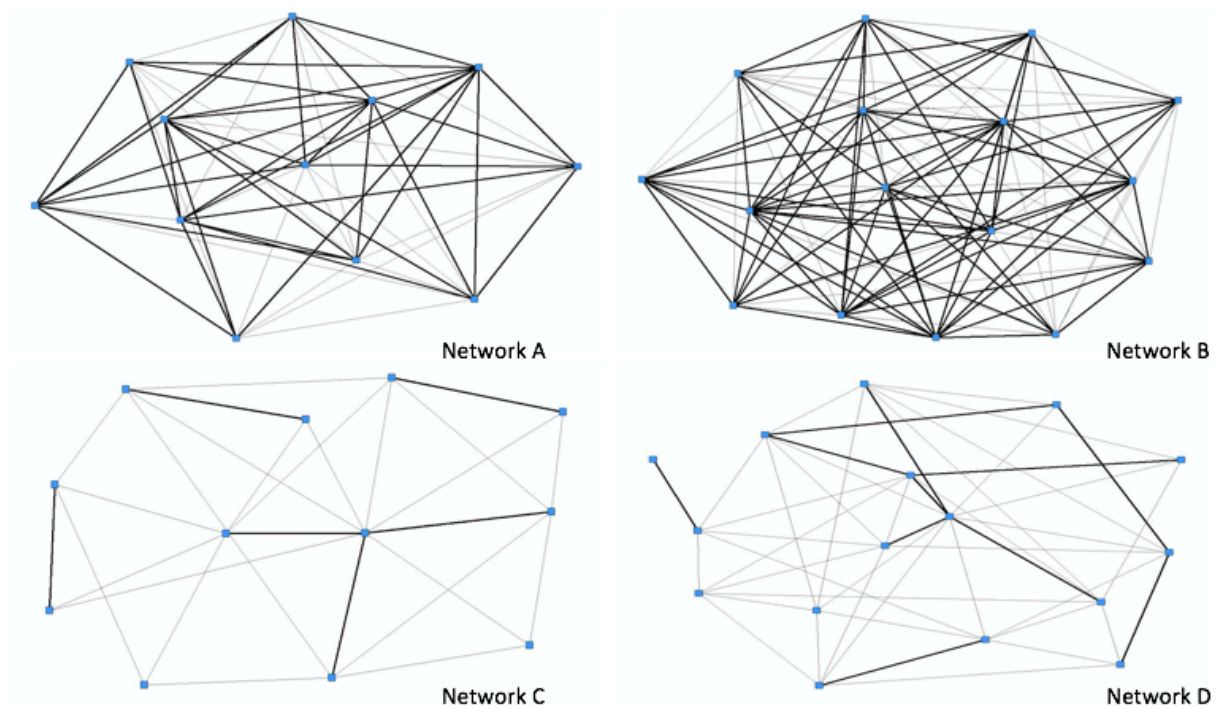


Figure 3.1

Graphic Image of Manipulated Information Exchange Networks in Study 3.

Note: Average individual degree centrality and network density were manipulated to create extreme groups. Network A is the 12-member higher centrality/higher density team, Network B is the 16-member higher centrality/higher density team, Network C is the 12-member lower centrality/lower density team, and Network D is the 16-member lower centrality/lower density team. This technique was adapted from research in organizational settings (Brands et al., 2015; Mehra et al., 2014).

One additional adjustment was made to increase the degree to which participants could relate to the described team. Specifically, the size of the network shown was adjusted for those who reported playing on smaller or larger teams. If participants stated initially that their respective sport team had 13 or less members, they were shown a team with 12 members. If participants reported more than 13 members, they were shown a team with 16 members. While these values were somewhat arbitrary, they were based on the average size of the most common sport teams emerging in the preliminary research on which this study was based (i.e., Study 1). For instance, basketball and volleyball teams typically have 10-12 members, while soccer and hockey teams typically have 15-18 members.

After reading the vignettes and imagining themselves as a member of the hypothetical team described, participants answered questions related to the anticipated task cohesion (GI-T; Carron et al., 1985) members of this team would perceive. In addition, to confirm that the team communication networks achieved the desired differences in member exchange, a 3-item short form of the Lee (1997) measure (i.e., positively-worded items only) was used as a manipulation check. Participants also answered a series of manipulation check questions related to the clarity, believability, and readability of the vignettes, as well as the degree to which they could imagine the team being described. Participants were offered the opportunity to enter a gift card draw to a local restaurant as potential compensation for their time.

3.3.2.3 Measures

Task cohesion. Perceived task cohesion was measured using an adapted version of the positively worded GI-T subscale of the GEQ (Carron et al., 1985; Eys et al., 2007). An example adaptation involved changing the item “Our team is united in trying to reach its goals for performance” to “This team would be united in trying to reach its goals for performance”. The original 9-point Likert-type scale of the GEQ was preserved, and higher averaged scores across the five items reflected higher anticipated task cohesion perceptions. Anticipated GI-T ($\alpha = .93$) demonstrated internal consistency, which was comparable to the results for GI-T in Study 1 and 2 using the original scale phrasing.

3.3.2.4 Data analysis

Data were screened for outliers, normality, and homogeneity of variance. To address the study hypothesis, an independent-samples t-test compared the difference between hypothetical whole team networks described with higher individual degree centrality/higher network density versus lower individual degree centrality/lower network density on anticipated task cohesion. Effect sizes and confidence intervals accompanied the analysis of group differences.

In addition, manipulation check questions were compared between study conditions to confirm (a) the intended differences in information exchanges (3-item short-form of the Cooperative Communication Scale; Lee, 1997), (b) the quality of the vignettes, and (c) the extent to which participants could imagine the described hypothetical team.

3.3.3 Results

The assumptions of the independent-samples t-test were satisfied. Univariate outliers ($n = 7$) and those participants who incorrectly recalled the interaction processes of the described hypothetical team (i.e., attention check; $n = 50$)⁴ were removed. This left 60 participants in the higher individual degree centrality/higher network density team description condition and 60 participants in the lower individual degree centrality/lower network density condition for the analysis⁵.

To test the Study 3 hypothesis, the results from an independent-sample t-test revealed a significant difference between team conditions, $t(118) = 18.10, p < .001$, Cohen's $d = 3.33$. Task cohesion was reported as higher for those exposed to the higher individual degree centrality/higher network density ($M = 7.27, SD = .99$) versus the lower individual degree centrality/lower density team description ($M = 3.56, SD = 1.25$; 95% CI_D [3.30, 4.12]). Based on Cohen's (1969) effect size recommendations, this difference would be classified as a large effect size.

Manipulation check. First, t-tests revealed that the team communication network vignettes achieved the desired differences in terms of member information exchange. Specifically, using a 3-item short-form of the Cooperative Communication Scale (Lee, 1997) information exchange was reported to be significantly higher for the higher individual degree centrality/higher network density ($M = 4.00, SD = .53$) compared with the lower individual degree centrality/lower network density team description ($M = 2.30, SD = .75, p < .001$). Mean scores also were compared between study conditions for vignette quality and no significant differences emerged (all $ps > .10$). Speaking to vignette quality, participants in both conditions

⁴ A comparison of means suggested no differences in demographic characteristics (i.e., age, sex, competitive level, years of sport experience, starting status, team size, and whether participants were currently competing on their team) between those who correctly recalled the degree to which members exchanged information and those who recalled incorrectly. As such, there appeared to be no systematic reasons that determined sensitivity to the manipulation.

⁵ To ensure that hypothetical team size did not account for differences in perceptions of task cohesion, a series of additional independent samples t-tests were performed. For the higher centrality/higher density condition, participants viewing smaller ($n = 25$) versus larger sized teams ($n = 35$) did not significantly differ in perceptions of GI-T ($p = .68$). For the lower centrality/lower density condition, those viewing smaller ($n = 27$) versus larger sized teams ($n = 37$) also did not significantly differ in perceptions of GI-T ($p = .13$). All manipulation-check measures, including cooperative communication, followed the same pattern of non-significant differences. As such, scores were combined across the team-size conditions vignettes.

found the vignettes made sense, were believable, and easy to read. Importantly, participants reported that they were able to imagine the team as described (mean scores ranged from 6.43 to 7.49 on a 9-point scale).

3.3.4 Discussion

The results from Study 3 revealed that when a team exchange network was structured with higher individual degree centrality and higher network density, a sample of team sport athletes reported higher perceived task cohesion when they imagined themselves a member. This study extended the findings of Study 2 to a whole network perspective and offered further support for the relationship between member information exchange and task cohesion. In addition, these results described a relationship in which varying the information exchange network structure resulted in different perceptions of task cohesion.

3.4 General Discussion

Although past research has established that communication between sport team members is positively associated with perceived cohesiveness (e.g., Kim et al., 2016; McLaren & Spink, 2018; Sullivan & Short, 2011), these links are primarily based on athlete perceptions. While informative, the extant results are limited because they cannot disentangle whether it is the communication patterns of the individual or of the team as a whole that relate to cohesion perceptions. As cohesion perceptions can be formed in part from these two sources (e.g., Carron & Brawley, 2000), using a measurement tool that allows for this differentiation is important for sport group dynamics research.

The purpose of this research was to examine the relationship between the structure of individual and whole team information exchange networks and task cohesion using a dyad-based measure (i.e., social network analysis; Borgatti et al., 2013). First, in support of this construct serving as a source of information associated with task cohesion perceptions, results from these Studies 2 and 3 suggested that communication appeared to be related to these perceptions from the perspective of information exchange network structure. In Study 2, athletes who reported communicating with a larger proportion of teammates in their individual (ego) network (compared with individuals with moderate and smaller sized ego networks) also perceived higher task cohesion from a group perspective (GI-T).

Study 3 included hypothetical whole team networks where individual and team components of the network structure could be examined together. As hypothesized, participants

exposed to a team network structure with higher individual degree centrality and higher network density reported higher anticipated task cohesion than those exposed to a network with lower individual degree centrality and network density. This finding builds upon the findings of Studies 1 and 2. It suggests that when individuals see that members of a team with which they identify (a) exchange information with a larger proportion of their teammates, and (b) see that the team as a whole engaged in more information exchange, then their judgements of task cohesion for that team are likely to be higher.

In Study 3, however, one question that emerged as a result of the design was the relative weight of individual degree centrality and network density in accounting for differences in task cohesion. Given that individual degree centrality was a part of both studies, and task cohesion differed based on individual network size, it can be stated with greater confidence that communicating with more members appeared to be associated with higher perceptions of team cohesiveness. However, as network density was considered together with individual degree centrality within the hypothetical network structure, its unique relationship to cohesion perceptions cannot be isolated. While the large effect size in Study 3 suggests that network density may have contributed additional variance to cohesion perceptions over individual degree centrality, alternative explanations exist (e.g., use of extreme, hypothetical teams). To tease out these different effects, future researchers will need to isolate the individual and team communication network structure of real world, intact sport teams. In this way, athletes who exchange information with differing proportions of teammates but share an overall network density can be compared in their perceptions of task cohesiveness.

A strength of Studies 2 and 3 was utilizing both a field study and hypothetical vignette design to establish the basic relationships between study variables. By manipulating the structure of information exchange under controlled conditions using vignettes, and randomly assigning participants to conditions, internal validity was enhanced in Study 3. This complemented the findings from the field study results reported in Study 2 where external validity might be assumed higher. Further, by replicating the same pattern of results using different research designs in each study (Klein et al., 2014), these studies add credence to the proposed research questions and tend to reduce the possibility that common method bias may have impacted the relationships (e.g., Podsakoff et al., 2003).

The use of hypothetical vignettes including both a descriptive and graphical representation to create a group structure also represents a novel methodology in the context of team sport (Mehra et al., 2014). Capturing the communication network structure in two different ways (i.e., written and visual) was done to increase the strength of the effect. However, it is possible that both sections of the vignette were not necessary to create the effect. To tease out the effects of each, future designs could use conditions that include either the written or visual information exchange network structure, which could then be compared to a condition that includes both.

In addition to these strengths, limitations are worth noting. For instance, data in Study 2 were collected near the end of the competitive season and, as a result, the conclusions drawn consider this. As such, one future research direction would be to examine the relationship with task cohesion at other points in the lifespan of a team when communication patterns may be more related to cohesiveness (i.e., early in group development; Balkundi & Harrison, 2006). The use of a prospective design in which the measure of member communication precedes the task cohesion measure also would contribute to examining the directionality proposed in the current research (e.g., Cronin et al., 2011).

Further, some limitations in Study 3 are noteworthy. For instance, Study 3 used an adapted version of the GI-T scale (Carron et al., 1985; Eys et al., 2007) given that hypothetical teams were the focus. As such, task cohesion was anticipated as opposed to being based on real-world perceptions, so the findings of the whole team information exchange networks to task cohesion relationship are bound by this observation. However, the similarity to the findings of Study 2 where cohesion was assessed based on actual perceptions would suggest otherwise. Further, the description of the lower individual centrality/lower network density condition team used the term ‘only’ in text, which may have inadvertently directed responses of task cohesion to the lower end of the scale, thus possibly artificially increasing between-group differences in cohesion perceptions.

3.5 Bridge to Study 4

To my knowledge, Studies 2 and 3 were the first in sport to examine information exchange in terms of the structure of personal (ego) and team (whole) networks. The findings demonstrated that task cohesion perceptions were higher under conditions in which athletes engaged in information exchange with a larger proportion of their teammates and the team as a whole. Given that Study 3 was conducted with hypothetical teams, one logical extension of this research would be to sample intact sport teams. With the preliminary nature of the research in mind, the aim of Study 4 was to examine the information exchange network structure and task cohesion in real-world, intact teams who had won or lost a head-to-head game.

CHAPTER 4

STUDY 4: COMMUNICATION NETWORK STRUCTURE AND TASK COHESION DIFFERENCES BETWEEN TEAMS THAT DIFFER IN A HEAD-TO-HEAD OUTCOME

4.1 Introduction

Many studies in sport examining group dynamics have focused on perceptions of group cohesiveness (Carron et al., 1985). From an applied perspective, why might it be of benefit for athletes to perceive higher cohesion within their sport team? For one, a positive link has been established between task cohesion and team performance outcome (Carron, Colman, et al., 2002). If members are united in their pursuit of task goals/objectives (e.g., winning), there is a higher likelihood of successful team performance outcome as more members are likely working together in the same direction.

While cohesion has been linked to team performance, a positive relationship also has been reported between the way members of a team exchange information and the degree of success teams achieved in other task-related groups such as organizational and work teams (e.g., DeChurch & Mesmer-Magnus, 2010). The fact that communication as information exchange and cohesion are both linked independently to group success may not be surprising given that the communication patterns that occur between athletes have been identified as one variable related to task cohesion. Specifically, athletes who perceived that the members of their team engaged in higher information exchange also perceived their team to be more cohesive around the team's task goals and objectives (Study 1).

Using social network analysis (Borgatti et al., 2013), the relationships between information exchange as a predictor variable and task cohesion and team performance outcome as dependent variables have been further refined. Results have demonstrated that when individual group members as well as the group as a whole engaged in higher information exchange, both task cohesion (Studies 2 and 3) and team performance outcome were higher (Balkundi & Harrison, 2006).

The purpose of Study 4 was to provide more evidence for the external validity of the relationships between team performance outcome and both communication and cohesion while controlling for task demands. According to Kerr (2017), it is important that the group task be considered if one wants to understand group behaviour. While sporting contests may appear

similar from the outside, the reality is that the task demands can change from one game to the next. Take soccer as an example. One game could be in the rain, the next in the sun, one could be a league game and the next for the league championship. As each of these factors change, the task demands change and successful group performance outcome will involve the ability to adapt to these changing task demands and initiate appropriate group processes (McGrath, 1997). When collapsing across teams and games, it might not be as clear whether any changes in group performance outcome resulted from differential group process such as the network of information exchanges or simply from a change in task demands. To control for the effect of these possible task demand changes across games, comparing the team processes associated with performance outcome in the same situation is ideal. This was done by comparing two teams competing head-to-head where one team wins and the other team loses.

Based on past research (e.g., Balkundi & Harrison, 2006), it was hypothesized that the winning team would engage in higher levels of information exchange. From a network structure perspective, this would mean that members on the successful team would engage in information exchange with a larger proportion of their teammates (i.e., higher individual degree centrality). This higher individual degree centrality would emerge both from an individual athlete reporting that he/she exchanged information with a higher number of teammates (i.e., outdegree centrality) and a higher number of teammates reporting that they exchanged information with him/her as well (i.e., indegree centrality). In addition to the individual members exchanging information, examining the team as a whole is important as an individual's information exchange (e.g., an athlete could interact with only a few teammates) could differ from the pattern of the entire team (e.g., remainder of the team interacts a lot). From a team perspective, higher information exchange would signify higher levels of member exchange across the entire team (i.e., higher network density). Combining these different aspects of member communication, higher information exchange would be associated with both individual members on average having more connections with others as well as the team as a whole engaging in more information exchange.

It also was hypothesized that members of the winning team would report higher perceived task cohesion than the losing team. Given that winning is the typical task goal in sport, it follows that perceiving the team to be united in the pursuit of this important objective (i.e., the constitutive definition of task cohesion) should be associated with the success of a team. This

hypothesis emanated from past research in sport demonstrating a positive relationship between perceived cohesion and team performance outcome (e.g., Carron, Colman, et al., 2002). A design involving two teams in a single match was appropriate at this stage of the research given the opportunity it provides to test methods and hypotheses under specific field conditions (Eisenhardt, 1989).

4.2 Method

4.2.1 Participants

Two competitive adult male soccer teams playing in a head-to-head game where one team won (Team A) and the other lost the game (Team B) were recruited to participate in this study. Of interest, Team A not only won the game but also was the more successful team overall. Prior to the game, the team had a winning points percentage in the league of .81 (i.e., 7 wins, 1 tie, 1 loss). Participants on Team A ($n = 13$) had an average age of 18.0 years ($SD = .90$), reported an average of 1.8 years of experience competing with their current team, and 12.4 years in soccer overall. Team B, who lost the head-to head game, also had a league history that matched its game outcome. It had a low winning points percentage of .22 (i.e., 2 wins, 0 ties, 7 losses) coming into the game. Those on Team B ($n = 13$) had an average age of 16.5 years ($SD = .52$), reported an average of 1.5 years of experience competing with their current team, and 8.7 years in soccer overall. The final score of the game was 4-0.

4.2.2 Procedure

Upon receiving University Research Ethics approval, I contacted the coaches of two male soccer teams (Appendix M) to explain the objectives of the research and ask for permission to recruit team members (Appendix N). After providing informed consent (Appendix O), participants completed a single questionnaire package immediately following the head-to-head game near the end of the season (Appendix P). It was made clear participants could ask for clarification, refrain from answering questions at their discretion, and could cease participation at any time without consequence. Participants were asked to refrain from communicating with one another during this process. Upon completion, participants were offered the opportunity to enter a draw to a local restaurant as potential compensation for their time.

4.3.3 Measures

Information exchange. To measure information exchange, participants listed the teammates in attendance on a grid that included designated spaces for names to be inserted. After

inserting the names, they were asked to consider the members with whom they exchanged information during the game. Specifically, the item “I openly exchanged information with these team members during the game” was presented and participants placed a checkmark next to the name of each player to which the statement applied (item adapted from Lee, 1997).

Participant responses to information exchange during the game were entered into an $n \times n$ adjacency matrix (i.e., participant names match in row and column number). The matrix can be described as follows. n is the number of team members present at that game and information exchange is defined using a binary 0 (did not exchange information) or 1 (did exchange information) code. Rows (i) represented the athletes with whom a specific individual reported exchanging information, while columns (j) represented those teammates who reported exchanging information with that same individual (i.e., directed network).

Task cohesion. Task cohesion was measured using the same instrument as Studies 1 and 2. In this study, GI-T demonstrated acceptable internal consistency ($\alpha = .79$).

4.3 Results

4.3.1 Social network analysis

Based on the adjacency matrices for information exchange between members of the winning (Team A) and losing team (Team B), social networks were compiled using UCINET (Borgatti, Everett, & Freeman, 2002). In these networks, individual athletes were represented by small squares, and connections between members identified those who exchanged information during the game (see Figure 4.1). From these networks, it was possible to compare metrics across two main categories—individual degree centrality and network density. Individual degree centrality provides an overview of the proportion of teammates with whom an individual athlete exchanged information during the game. More specifically, it is the number of teammates with whom an individual member reported exchanging information (outdegree centrality) as well as the number of teammates reporting information exchange with that same individual member (indegree centrality). These two values are averaged to generate individual degree centrality. Therefore, having a higher individual degree centrality value would signify that a member engaged in higher information exchange with other teammates. Averaging the values of all members of a team provides an indication of the information exchange behaviour of the average member (i.e., average individual degree centrality). As individuals do not report exchanging information with themselves, the maximum value is equal to $n - 1$.

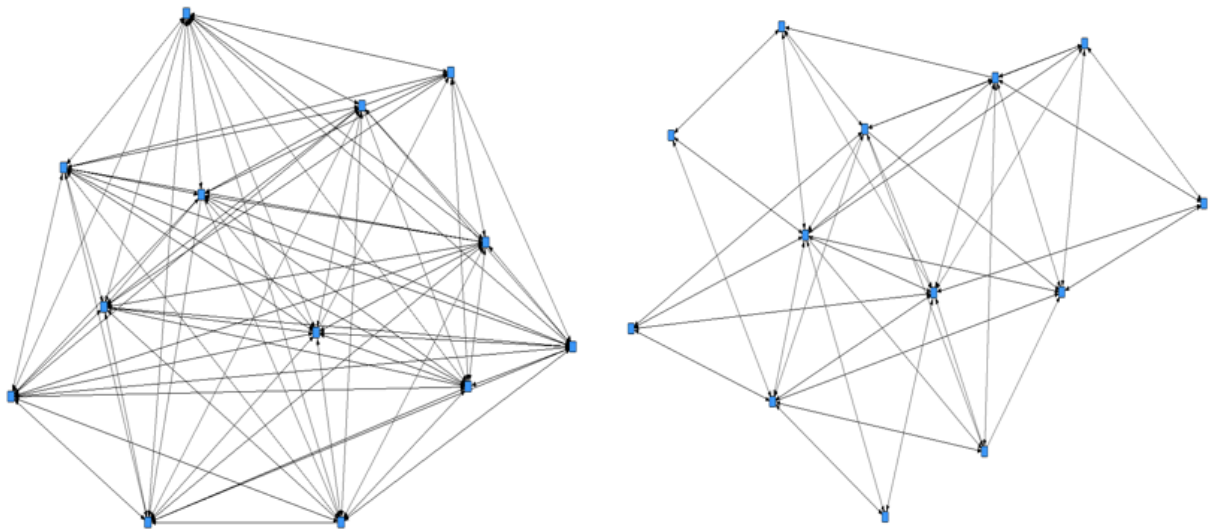


Figure 4.1

Study 4 Information exchange social networks.

Note: The winning team (Team A) is represented on the left, and the losing team (Team B) on the right. Small squares represent the individual athletes and directed arrows represent athletes who exchanged information during the head-to-head game. The direction of the arrow identifies that an individual exchanged information with the other member during the game.

In the current study, each team had a maximum value of 12, which would reflect each teammate exchanging information with all other teammates during the game. A value of 0 would mean that no members exchanged information.

The results of this study demonstrated that the winning team had a higher average individual degree centrality value (10.1) compared with the losing team (5.6). In terms of communication, the average member on the winning team exchanged information with nearly 11 other members during the game, whereas the average member of the losing team exchanged information with just over six members. Clearly, information exchange was much different on the losing team where a member on average only identified (and was subsequently identified by) about half of the possible number of teammates for exchanging information during the game.

From the perspective of the team, network density is more representative of the overall team structure as it captures the number of reported information exchanges during the game compared with the total number of exchanges possible between all team members. Network

density increases as more members engage in information exchange with a larger proportion of their teammates, and the density value can range from 0 to 1. A score of 1 would reflect each member exchanging information with all other team members and a score of 0 would reflect no members exchanging information. In this study, the winning team had a higher network density score (.84) than the losing team (.47). In practical terms this means that 84% of the total possible connections due to exchanging information were present on Team A (i.e., 131 reported out of 156 possible), while only 47% were present on Team B (i.e., 73 reported of 156 possible). Accordingly, the density of the winning team's communication network was higher than the losing team, which can be seen graphically in Figure 4.1. Taken together, the individual centrality and network density scores of the information exchange networks support the first hypothesis that members of the winning team would engage in a higher proportion of information exchange at the individual- and team-level.

4.3.2 Task cohesion

Perceived task cohesion (GI-T) was compared between the two teams to test for differences. An independent-samples t-test revealed a significant difference between the two teams, $t(24) = 3.58$, $p = .002$, 95% CI_D [.60, 2.22], Cohen's $d = 1.28$. According to Cohen's (1969) effect size recommendations, this would classify as a large effect. In terms of direction, the results revealed that members of the winning team reported higher task cohesion ($M = 7.34$, $SD = .99$) than the losing team ($M = 5.93$, $SD = 1.22$). This difference supported the second study hypothesis.

4.4 Discussion

In past research, it has been reported that team performance outcome can be differentiated by both the information exchange behaviours of team members (e.g., DeChurch & Mesmer-Magnus, 2010) and the degree to which the team is perceived as cohesive (e.g., Carron Colman, et al., 2002). In terms of the former, it would be expected that a successful team should have an information exchange network characterized by a higher proportion of exchanges at the individual and the team level (e.g., Studies 2 and 3; Balkundi & Harrison, 2006). On the cohesion side, the expectation would be that a successful team also should perceive the team to be more task cohesive. Although these relationships typically are couched in terms of overall sport team performance, it is reasonable to assume that if past history of behaviour is influential, the pattern of results should continue and exist within a specific head-to-head game situation.

The purpose of the current study was to test the relationships between team performance outcome and both communication and cohesion in a setting where the performance outcome was derived from the same situation and task demands were held constant (i.e., both teams were exposed to the same task demands). Consistent with the first study hypothesis, the sport team who won the game demonstrated an information exchange network with higher individual degree centrality and network density metrics. Compared to the losing team, members of this winning team reported engaging in information exchange with more teammates and were subsequently identified by more teammates as someone with whom they exchanged information during the game. In addition, it was found that the winning team as a whole engaged in more information exchange. These findings aligned with research in other task-based groups (e.g., DeChurch & Mesmer-Magnus, 2010).

In addition to an information exchange network that was structured in different ways, the members on the winning team perceived higher task cohesion when compared with the losing team. As winning is a valued task-based objective of sport, it follows that perceiving the team to be united in trying to win would be associated with the team being more successful. This finding paralleled past cohesion/performance outcome research in sport (e.g., Carron, Colman, et al., 2002), which also suggested that more cohesive teams were associated with higher team performance.

The use of a single head-to-head game between two teams allowed the hypotheses to be tested within a specific real-world context (Eisenhardt, 1989) where the task demands of the situation remained the same (Kerr, 2017). Thus, the observed differences in communication and perceived cohesion between the team that won and lost the head-to-head game could be attributed more to actual team processes (i.e., information exchange network structure and perceived task cohesion) than to any possible moderating effect. By sampling one game, possible game-to-game changes (e.g., competing against a difficult opponent in one game and an easy opponent in another) that could alter the task demands (e.g., trying to win versus trying not to lose) were controlled (Kerr, 2017).

In terms of study limitations, the current design does not allow for the individual effects of the information exchange network structure and task cohesion to be teased apart in explaining why one team was more successful and the other was not (i.e., team performance). I would be remiss not to acknowledge that the team who won the game and the team who lost the game had

previous performance outcome histories that matched the immediate head-to-head outcome (e.g., winning team had a history of success and the losing team had a history of failure in the league). Thus, it is not possible to discern whether communication and task cohesion differences were associated with the more immediate win/loss outcome of the game, the histories of each team, or some combination of the two.

One interesting future research direction would be to test for differences in communication patterns and perceived cohesion if the less successful team (historically) won the game, or vice versa. As either of these situations may serve as a condition to disrupt the typical state of the team (e.g., Marks et al., 2001), different group processes might have been present during the games. For instance, consider the communication behaviours required for a successful outcome for a team with a history of success who expects to win the game. If the team expecting to win falls behind early and loses the game, does the pattern of communication change from high information exchange with teammates as found in this study for the historically successful team to less information exchange as players try to do it all on their own? Does this change in communication alter task cohesion perceptions during the game? This awaits future research.

Future researchers also should test the relationship between team performance outcome and both the structure of information exchange networks and perceived task cohesion across a number of intact sport teams competing in head-to-head games. This should be done while recognizing and accounting for possible different task demands that could arise across games.

Based on the results, it also is important to acknowledge that possible alternative explanations exist for the current findings. Demographics revealed that the members of the winning team were older and more experienced. Thus, it is possible that this greater experience across members may have contributed to its game-day win owing to enhanced individual decision making or the ability of members to cope better with uncertainties. Or, alternatively, the more experienced athletes may not have needed to exchange information as often because they were more familiar with one another and processed information differently. By replicating these results in a larger sample, alternative explanation such as these could be understood as a true moderator or artifact of the specific teams under study.

4.5 Bridge to Study 5

The results from the previous four studies have provided preliminary evidence for communication as information exchange as a potential source of information that helps form task cohesion perceptions. One step in providing evidence that the process of member information exchange may relate to future estimates of team cohesion is to temporally separate the measures in a prospective design (Cronin et al., 2011). Further, a larger sample of intact sport teams would extend the Study 4 findings and allow for the individual- and team-levels of the communication network structure to be tested as separate independent variables in the prediction of task cohesion and team performance. The purpose of Study 5 was to test these predictive relationships across time in a sample of intact sport teams.

CHAPTER 5

STUDY 5: COMMUNICATION NETWORK STRUCTURE AS A POSSIBLE PREDICTOR OF TASK COHESION AND TEAM PERFORMANCE ACROSS TIME

5.1 Introduction

Although support for group cohesion as a key variable in sport has been well established (e.g., Carron & Eys, 2012; Spink, 2016), the processes by which individual members come to draw cohesion perceptions is less understood (Spink et al., in press). From an applied perspective, understanding the possible origins of these perceptions is a necessary starting point if the goal is to alter group cohesion perceptions. Given that the most accepted definition of cohesion in the sport setting currently suggests that cohesion “...develops as a function of the socialization and interaction processes that occur within groups...” (Carron & Brawley, 2000, p. 102), one variable that could serve as a potential cue for cohesiveness is the structure of member communication.

Acknowledging the importance that member communication structure has to the group is not a new idea (e.g., Leavitt, 1951; McGrath, 1984; Shaw, 1964). Extending communication to the possible communication structure/group cohesion interface, Cartwright (1968) described the structure of group interactions as one incentive property that members consider in determining the attractiveness of a group. As noted previously, members are more satisfied with their membership in high task complexity groups (and hence more likely to remain) when the structure of communication is decentralized, and members possess the capacity to be involved in the flow of information within the group (i.e., communicate with many others).

Further, it has been suggested that social network analysis (Borgatti et al., 2013) is one measurement tool that is appropriate for studying member communication structure (Studies 2, 3, and 4; Wäsche, Dickson, Woll, & Brandes, 2017). By modeling the social relations among members of a group, social network analysis offers a unique perspective based on specific dyadic connections (e.g., two members who communicate; Borgatti et al., 2013). This perspective can be partitioned into individual ego networks and whole networks, each with accompanying network metrics. According to preliminary research in sport, individual degree centrality and network density are two metrics that capture these levels (Studies 3 and 4).

Specifically, the centrality of each individual within the team can be calculated in two ways based on the degree to which that member is central in the network. Using a nomination

procedure, the proportion of group members with whom an individual communicates is known as outdegree centrality, while the proportion of group members who communicate with that same member is known as indegree centrality. It is assumed that the more central a member is in a communication network (based on the number of outdegree and indegree nominations) the larger the role they play in the flow of communication within the group.

The aggregation of all individual ego networks within a specific group represents the whole network. This provides the density of the network as a proportion of how many connections exist between members and the total number of connections possible. When more individuals communicate with a larger proportion of teammates, this translates to the team engaging in more communication as a whole.

Social network analysis in sport has been used to examine variables such as athlete leadership (Fransen et al., 2015), team coordination (Bourbousson et al., 2015), and team performance (Warner, Bowers, & Dixon, 2012). Until recently (Studies 2, 3, and 4), this analysis technique has not been used to measure the communication structure of sport teams despite reviews highlighting its utility (e.g., Ishak, 2017; Wäsche et al., 2017). Further, understanding the communication practices of an individual member as well as the communication practices of the sport team as a whole (via network structure) would be of value in testing its value as a potential source of information in forming cohesion perceptions (Carron & Brawley, 2000).

This method of modeling the team network structure is important because, to date, the small knowledge base related to communication and cohesion in sport is largely based on individual athlete perceptions (e.g., Kim et al., 2016; McLaren & Spink, 2018; Mishra, Sharma, & Kamalanabhan, 2016; Smith et al., 2013; Sullivan & Short, 2011). While informative, these results are limited to the source of the perception. For instance, it is possible that an athlete is referencing the general communication tendencies of the team, but this may not reflect his/her own patterns of communication. Similarly, an athlete could be referencing only the athletes with whom they are closest as opposed to the entire team. If a positive relationship emerged between communication and cohesion in either example, differentiating whether the cohesion effects were due to communication patterns associated with the individual or the team would be difficult to disentangle. Given its ability to tease out these differences, results using social network analysis would add value to the existing knowledge base (Wäsche et al., 2017).

Related to the individual and team aspects of social network structure, Balkundi and Harrison (2006) conducted a meta-analysis to synthesize the network structure/attraction to the team (operationalized as team viability) relationship in a sample of 3098 intact organizational groups (average $n = 8$). Overall, the results supported the theorizing of early group dynamics research that a dense network made up of task-related (i.e., instrumental) connections between members (who themselves also are well-connected) would be positively associated with team viability (which included measures of team cohesiveness). It was argued that teams with more instrumental connections would be those who communicate often and, as a result, identify and resolve possible conflict, which could serve to reduce the likelihood of fragmentation and increase cohesiveness (Balkundi & Harrison, 2006).

Preliminary empirical research in sport designed to test the association between the individual- and team-level components of communication network structure and group cohesion supported the finding that a higher proportion of team member communication is associated with higher cohesion perceptions (e.g., Studies 2, 3, and 4). This sport research used information exchange to capture the relationship between communication among members and task cohesion as the relevant cohesion dimension for the exchange of information (versus social cohesion). The results of individual network structure research revealed that when members engaged in information exchange with a higher proportion of teammates, perceptions of task cohesion also appeared to be higher (Study 2). In a follow-up to this research, higher individual degree centrality and network density together were associated with higher perceived cohesiveness using both hypothetical (Study 3) and actual whole network structures derived from a single head-to-head game (Study 4).

These findings have face validity as engaging in information exchange with teammates should provide an athlete with an approximation as to how united the team is in pursuit of its task goals and objectives (i.e., task cohesion). When individuals exchange information with a higher proportion of their teammates (Study 2) and this translates to the team-level (Studies 3 and 4), one plausible interpretation by the individual is that teammates are ‘in it together’ in pursuing these goals (i.e., higher in task cohesion).

One other conclusion drawn in early group dynamics research (e.g., Leavitt, 1951) and confirmed with meta-analytic findings (Balkundi & Harrison, 2006) is that team performance is associated with information exchange network structure. Under controlled conditions of differing

task complexity, the manner in which group members exchanged information with one another made a difference in how quickly and effectively they performed laboratory tasks (Leavitt, 1951; Shaw, 1964). In the context of sport, which is highly complex, it is necessary to send and receive information in an efficient way such that the members of the team can take advantage of the opportunities presented in an effort to enhance team success.

Consistent with research from organizational group dynamics (e.g., Balkundi & Harrison, 2006; DeChurch & Mesmer-Magnus, 2010), a dense communication network (more information exchange between a higher proportion of members) has been associated with higher team performance. Specifically, when members of the team have multiple options for information exchange during the game, it is more likely that the appropriate information can be exchanged. In this way, the likelihood of process losses stemming from lack of information would decrease, and team effectiveness could increase (e.g., Steiner, 1972).

What has not been addressed to date in sport, however, is a test of these relationships discussed in the previous paragraph across time. This is important because gathering cross-sectional data might miss how the variables are associated with each other at different points in the development of a group (Cronin et al., 2011). As the constitutive definition of cohesion in sport explicitly describes cohesion as "...a dynamic process..." (Carron et al., 1998, p. 213), at some point research designs need to treat cohesion perceptions accordingly.

As described above, social network analysis allows the researcher the ability to parcel the team communication structure into its individual and team measurement components. Any team-level network structure is composed of a number of different individuals, all of whom have the capacity to engage in different amounts of information exchange. However, all members of a team have in common the overall density of their team network. Thus, the possibility exists that task cohesion and team performance may relate differentially to information exchange network structure vis-à-vis the individual and team communication levels of the network. Further, these relationships can be couched in McGrath, Arrow, and Berdahl's (2000) theorizing that group dynamics consists of both local and global dynamics. Local dynamics are the activities of a group's constituent elements (e.g., interactions between group members) and give rise across time to system-level elements of the team, known as global dynamics (e.g., cohesion, team performance; see Cronin et al., 2011; McGrath et al., 2000). The local and global dynamics also exist within the specific context of that group.

The purpose of Study 5 was to test the relationship between information exchange network structure and the future variables of task cohesion and team performance. To date, preliminary research has been based on individual perceptions (Study 1), ego and hypothetical whole networks (Studies 2 and 3), and a study of two intact teams competing in a single head-to-head match (Study 4). Collectively, these results suggest that information exchange carried out between higher proportions of members in a decentralized fashion is associated with higher perceptions of task cohesion and overall team performance. However, one additional step in testing information exchange as a potential cue for sport group cohesiveness, and the relationship between information exchange and sport team performance is to implement a design in which the communication measure precedes the assessment of cohesion and performance.

To improve upon past network structure research predicting task cohesion and team performance, other changes were incorporated in the study design and analysis. First, the network structure/cohesion and network structure/performance relationships can be better informed by factoring in individual- and team-level effects related to the operationalization of communication (Cronin et al., 2011). Second, the study design included the temporal sequencing of variables in a prospective design. Third, given that past meta-analytic findings have demonstrated that network structure is most predictive of cohesion and performance earlier in the lifespan of a group (Balkundi & Harrison, 2006), these relationships were tested across the first half of the competitive season of intact sport teams.

Two hypotheses were posited for the current study. It was hypothesized that an information exchange network structure higher in individual outdegree centrality (individual level) and network density (team level) at an early season measurement period would positively predict task cohesion perceptions near midseason. By including both measures, members may consider the information exchange behaviours engaged in personally (individual outdegree centrality) as well as the degree to which the team engaged in these behaviours as a whole (network density) before making an assessment of how united the team is in pursuit of task goals and objectives (i.e., task cohesion). Because indegree centrality is a metric that comes about as a result of other members engaging in information exchange (and experiencing the social situation of the group from their own perspective), it was hypothesized that no relationship with task cohesion would emerge.

Second, team performance represents a team-level variable that is evidenced by the overall ability of the team to integrate its component parts. Therefore, the information exchange behaviours of each member on his/her own is less likely to dictate how effective a team can be overall. From an intuitive perspective, it is more likely that the information exchange of all members together would be associated with team performance. As such, it was hypothesized that higher network density (team level) at an early season measurement period would positively predict team performance near midseason, while early season individual outdegree and indegree centrality (individual level) would exhibit no significant relationship with performance.

5.2 Method

5.2.1 Participants

Participants in this study were adult basketball athletes ($N = 133$; 25% female) who competed on competitive teams in two adult sport leagues. Specifically, male athletes were recruited from teams in the top 2 divisions of a six-division league ($k = 11$), while females were recruited from teams in the top division of a four-division league ($k = 4$). Participants had an average age of 27.4 ($SD = 7.5$ years, range 18-53), and an average of 17.4 and 4.4 years of experience competing in basketball, and on their current team, respectively. With respect to status, 95 athletes (71%) self-identified as a starter. A portion of the teams (6 of 15 total teams) in this sample also completed Study 2, but that data collection occurred in a different season. However, it is worth noting that the cross-over teams were not identical as leaders of these teams told the researcher that new athletes had joined while others had left the teams between the two seasons.

5.2.2 Procedure

Following University Research Ethics approval, I contacted team representatives listed on the league websites with an explanation of the research project (Appendix M). At this time, permission also was requested from the team representatives to recruit the remaining members of the team at a weekly game early in the competitive season (Appendix N). After providing informed consent to participate in the research (Appendix O), participants completed two separate questionnaires—the first before the end of the fourth game of the season and the second before the end of the eighth game of the season (Appendix Q). All teams were scheduled to compete in 15 regular season games.

At each measurement point, participants independently completed a questionnaire package under the supervision of the lead researcher. All participants were informed that they could ask questions in the event that clarification was required, and withdrawal from the study was possible at any time. Confidentiality was assured from teammates, and participants were offered the ability to request an executive summary of the results upon study completion, which lasted approximately 10 minutes at each measurement point (20 minutes total). Finally, participants could enter a draw each time they completed a questionnaire (maximum 2 times) for a gift card to a local restaurant as potential compensation for their participation.

5.2.3 Measures

Information exchange. Information exchange network structure at early season and midseason was generated using the same instrument as Study 4.

Task cohesion. Perceptions of task cohesion at early and midseason were measured using the same instrument as Studies 1, 2, and 4. At both measurement points, one item (“If members of our team have problems in practice, everyone wants to help them so we can get back together again”) was removed for conceptual reasons as most teams did not have separate practices. This differed from Studies 2 and 4 because participants indicated that practice was a regular part of their team as the season progressed (i.e., near end of season). Internal consistency after removing this item was found to be acceptable at both time points ($\alpha_{\text{early season}} = .83$, $\alpha_{\text{midseason}} = .85$).

Team performance. To measure team performance, the winning percentage of a team was calculated based on the number of games won as a proportion of the total number of games played at the early and midseason measurement point. For example, a team with 3 wins in 4 total games would have a score of .750, where higher scores (ranging from 0 to 1) reflected greater performance. This measure was similar to that used in other sport team performance research (e.g., Becker & Solomon, 2005; Benson et al., 2016).

5.2.4 Data analysis

Prior to the main analysis, data were screened for normality and multicollinearity. Using a prospective design, the two study hypotheses were tested in different ways. To test the network structure/task cohesion relationship, multilevel modeling using hierarchical linear modeling (HLM) was used. This was possible because midseason task cohesion was measured at the individual level (a requirement of HLM) and, therefore, variance could be accounted for at the

individual (level 1) and team level (level 2) (Raudenbush & Bryk, 2002). The deviance statistics were compared across two nested models to determine if adding network metrics in the full model predicted unique variance in midseason task cohesion beyond that accounted for by early season task cohesion perceptions alone (which was tested separately as the lone predictor in a smaller, control model 1) (see Raudenbush & Bryk, 2002). For the full model (model 2), early season task cohesion and early season indegree and outdegree centrality as level 1 predictors of midseason task cohesion, and early season network density as a level 2 predictor, were added.

To test the network structure/team performance relationship, a hierarchical multiple regression was used because team performance was measured at the group level (i.e., level 2) and HLM requires a level 1 outcome measure. At step 1 of the regression predicting midseason team performance, early season team performance was added as a control variable, while early season network density and both indegree and outdegree centrality were added at step 2. To determine the degree to which the communication network structure accounted for the variance in midseason team performance, the change in variance accounted for and semi-partial correlations were examined in the final model.

5.3 Results

5.3.1 Preliminary analyses

Testing for the assumptions of multilevel and hierarchical multiple regression analyses revealed that multicollinearity between study variables was not a concern. In terms of normality, GI-T perceptions both at early and midseason demonstrated a negative skew. Given that the study results were the same for raw and transformed (reflected and base-10 logarithm; Tabachnick & Fidell, 2013) values, the raw scores were retained to ease interpretation of regression weights. Descriptive statistics are provided in Table 5.1.

Table 5.1

Study 5 Descriptive Statistics for Study Variables

	Mean (SD)	(2)	(3)	(4)	(5)	(6)	(7)
(1) ES Indegree Centrality	.84 (.15)	.39***	.59***	.23*	.10	.25*	.23*
(2) ES Outdegree Centrality	.85 (.22)	--	.40***	.44***	.06	.66***	.15
(3) ES Network Density	.84 (.09)		--	.32**	.14	.47***	.38***
(4) ES Task Cohesion	7.74 (1.21)			--	.12	.71***	.09
(5) ES Team Performance	.52 (.32)				--	.11	.70***
(6) MS Task Cohesion	7.83 (1.20)					--	.21*
(7) MS Team Performance	.56 (.21)						--

Note: ES represents early season measures and MS represents midseason measures. * $p < .05$. ** $p < .01$. *** $p < .001$

Given that participants were able to participate at either of the two measurement periods, a distribution of those present only at early season ($n = 31$), only at midseason ($n = 24$), or at both early and midseason ($n = 78$) existed. Further, the number of participants potentially eligible for the main analysis differed. In the case of task cohesion, it was necessary for participants to be present at early season and midseason to provide both information exchange network structure and perceptions of cohesion ($n = 78$). However, for team performance, participants only needed to be present at the early season measurement to provide their information exchange behaviours. Team performance was objective and could be observed independent of whether athletes were present at midseason ($n = 109$).⁶

5.3.2 Network metrics predicting midseason task cohesion.

To check for interdependence of responses within teams, an intraclass correlation (ICC) value was computed for midseason task cohesion (dependent variable). To do this, a null model (no predictors) was tested to partition the variance across level 1 and 2 (Raudenbush & Bryk,

⁶ All data were collected following a weekly game. As such, the current game outcome at the early season measurement period also was entered as a control variable in predicting midseason task cohesion and team performance. In both cases, the results were the same with the variable entered or not entered. To maximize power, the game outcome at early season was not entered as a second control variable.

2002). The resulting ICC for task cohesion (i.e., GI-T) was 0.23. This suggests that a meaningful amount of variance is housed at the team level (23%). According to Schoemann, Rhemtulla, and Little (2014), ICC values above .05 may indicate that individuals' responses are likely to be more similar to others on their team than that of athletes on another team, and a multilevel model is appropriate. Models were estimated using full maximum likelihood and slopes were fixed. Predictor variables were centered on their grand mean (Kreft, de Leeuw, & Aiken, 1995). Due to a low number of participants in 3 of the level 2 units (teams), only 12 teams and 70 participants were eligible for the main analysis.⁷ One other participant was removed as a univariate outlier.

In model 1, not surprisingly early season task cohesion ($b = .61, p < .001$) accounted for 34% of the variance in midseason task cohesion as the lone level 1 predictor variable. In the full model (model 2), the addition of early season indegree and outdegree centrality at level 1, and early season network density at level 2 accounted for an additional 26% of the variance in midseason task cohesion perceptions. An overview of both models can be found in Table 5.2.

Upon comparing the deviance statistics under a chi-square distribution, this increase in variance between the models was significant ($p < .001$). An examination of the specific predictors revealed that early season outdegree centrality ($b = 2.43, p < .001$) and early season task cohesion ($b = .42, p < .001$) were significant indicators of midseason task cohesion. Both early season network density ($b = 2.41, p = .09$) and early season indegree centrality ($b = -.13, p = .85$) were not significantly related to midseason task cohesion perceptions.

⁷ While multilevel modeling is considered to be a larger sample technique (e.g., Maas & Hox, 2005), the current study sampled teams that were by nature (a) smaller in size and (b) open to fluctuations in member attendance over time. To address the potential sample size issue an individual-level analysis (i.e., hierarchical regression) also was conducted and the results were the same, which offers confidence in the multilevel findings.

Table 5.2

Fixed Effects Estimates (Top) and Variance-Covariance Estimates (Bottom) for Model Predicting Midseason Task Cohesion

Parameter	Null Model	Model 1	Model 2
Fixed Effects			
Intercept	7.92 (.18)***	7.92 (.15)***	7.92 (.10)***
Level 1			
ES Task Cohesion		.61 (.10)***	.42 (.09)***
ES Indegree Centrality			-.13 (.69)
ES Outdegree Centrality			2.43 (.45)***
Level 2			
ES Network Density			2.41 (1.31) [†]
Random Parameters			
Level 1	.93	.59	.44
Level 2	.27	.20	.05
Deviance Statistic	212.35	180.82	150.82
Parameters	3	4	7
Chi-square	34.42***	38.20***	20.77*
Variance Estimates			
Level 1		28%	41%
Level 2		6%	19%
Total		34%	60%

Note: ES represents early season measure. Model 1 is the smaller, control model with early season task cohesion as the lone predictor of midseason task cohesion. Model 2 is the full model with early season task cohesion and early season network metrics as predictors of midseason task cohesion. [†] $p < .10$ * $p < .05$. ** $p < .01$. *** $p < .001$.

5.3.3 Network metrics predicting midseason team performance.

Given that team performance is a level 2 (group) variable, the second hypothesis was tested using hierarchical multiple regression. At step 1, early season team performance ($sr = .69$) significantly predicted midseason team performance, accounting for 42% of the variance in midseason team performance. The inclusion of early season indegree and outdegree centrality

and early season network density at step 2 significantly increased the variance accounted for in midseason team performance, $R^2_{\text{change}} = .06, p = .001$. Standardized estimates revealed that early season network density ($sr = .23$) and early season team performance ($sr = .65$) were significant predictors of midseason team performance ($ps < .01$), while indegree ($sr = .00$) and outdegree centrality ($sr = .00$) were not ($ps > .95$). In the final model, the variance accounted for was 48%. A full overview of the regression analysis can be found in Table 5.3.

Table 5.3

Early Season Network Structure Predicting Midseason Team Performance

Variable	R^2_{adjusted}	F (degrees of freedom)	β	sr	t
<i>DV: MS Team Winning Percentage</i>					
Step 1:	.42	98.59*** (1, 107)			
ES Team Winning Percentage			.69	.69	9.93***
Step 2:	.48	33.04*** (4, 104)			
ES Team Winning Percentage			.65	.65	9.93***
ES Indegree Centrality			-.01	-.00	-.06
ES Outdegree Centrality			.00	.00	-.04
ES Network Density			.29	.23	3.46**

Note: ES represents early season measures and MS midseason measures. sr is the semi-partial correlation. ** $p < .01$. *** $p < .001$

5.4 Discussion

The importance of perceived group cohesion in sport is evidenced by reported links to important individual- (e.g., adherence; Spink et al., 2010) and group-level outcomes (e.g., team performance; Carron, Colman, et al., 2002). Further, it has been argued in recent research that the sport group dynamics knowledge base would benefit from a better understanding of the sources of information from which athletes estimate cohesion perceptions (e.g., Spink et al., in

press). A basic component of groups that could serve as one of these potential cues is the structure of member communication (e.g., Cartwright, 1968; McGrath 1984).

The purpose of the current study was to constructively replicate the relationship between member communication and task cohesion, and test the relationship between information exchange and team performance. Based on preliminary research in this area (Studies 1, 2, 3, and 4), the constructive aspect of this replication involved a prospective field design with intact sport teams. Further, generating whole communication networks focused on the exchange of information allowed for an examination of the specific exchanges between members and how these exchanges existed within the context of a specific team.

First, the results revealed that athletes who reported exchanging information with a higher proportion of their teammates early in the season (i.e., outdegree centrality) also perceived higher task cohesion at midseason. As expected, indegree centrality, which is the proportion of teammates who reported exchanging information with that same individual, was not a significant predictor of task cohesion. However, unexpectedly, the overall density of the network based on the reported exchanges between all team members at an early season game (i.e., network density) did not contribute a significant portion of variance in midseason task cohesion perceptions. As such, partial support for the first hypothesis was found.

In addition, the results of the current study revealed that the information exchange network density significantly predicted midseason team performance while indegree and outdegree centrality did not, supporting the second hypothesis. As such, these findings suggest greater objective team performance scores for teams where members engaged in a higher degree of information exchange (i.e., higher network density). One potential interpretation of this finding could be that when the network is higher in density (e.g., more overall members exchanging information), this may decrease the likelihood that gaps, or structural holes, exist whereby the potential effectiveness of the team can be dampened by process losses (Steiner, 1972). Of course, this interpretation assumes that athletes are exchanging and processing the appropriate types of information at the appropriate times (e.g., Hinsz et al., 1997). In a team sport such as basketball (as used in this study), having just a few members who are not well connected may be the difference between higher and lower success because the maximum number of possible connections are lower at the outset. Also, while individual indegree and outdegree

centrality metrics comprise a small portion of this overall network, the current results suggest they do not appear to predict objective team winning percentage (performance) on their own.

One interesting finding of Study 5 was that the levels of the communication network structure were related differentially to task cohesion and team performance. Perceived task cohesion is an individual-level variable that reflects a personal belief about the degree to which the team is united around task goals and objectives (Carron et al., 1985). As cohesion perceptions are drawn in part by combining personal experiences within the group and the reality of the group as a whole (Carron & Brawley, 2000), it was hypothesized that outdegree centrality and network density early in the season would predict midseason task cohesion perceptions.

The finding that only individual outdegree centrality predicted task cohesion across time may reflect the fact that individual athletes know exactly who they exchange information with but may not be privy to the connectedness of all members together. As hypothesized, the finding that outdegree centrality, not indegree, was the significant predictor would further reflect the fact that individual athletes are processing their own personal experiences within the team as opposed to the experiences of other athletes (Carron & Brawley, 2000).

According to terminology used by McGrath and colleagues (2000), this may be a within-level match across local and global dynamics. That is, individual information exchange at the local level was related to individuals drawing perceptions of task cohesion at the global level. Using this explanation, it also may not come as a surprise that a team-level aspect of communication network structure (a local dynamic) was related to objective team performance, which is a global dynamics variable captured at the team-level. Using the multilevel feedback loops outlined by Cronin and colleagues (2011, p. 581), these preliminary findings suggest that different aspects of the same individual, local dynamics variable (i.e., member communication as information exchange) are associated with a group, global dynamics variable at a subsequent point in a specific group's development.

The current study had strengths worth recognizing. First, the consideration of the individual and group levels of the communication network structure allowed for greater specificity in terms of which structural properties predicted task cohesion and team performance. In past research, metrics of individual degree centrality and network density have been considered together using hypothetical vignettes (Study 3) and a study of two teams with differing overall success (Study 4). Although member communication is a local dynamic,

individual degree centrality was associated with the individual-level outcome of perceived task cohesion, while whole group network density was associated with the group-level outcome of objective team performance.

From a measurement perspective, two other strengths emerge. First, the use of a prospective design offered added confidence in the directionality proposed in past research (Studies 1, 2, 3, and 4). It has been argued that member communication may be one potential cue for estimating perceptions of cohesion in sport; however, much of the extant research is based on concurrent research designs. Although an experimental design is needed to establish this claim, consistently replicating the finding that higher information exchange between a larger proportion of team members is associated with higher task cohesion and team performance offered added confidence for this relationship (Klein et al., 2014). These results appear to exist above-and-beyond the early season measures of each outcome variable, which were controlled in the analyses of this study.

Second, past research sampled athletes from intact sport teams but was unable to compile whole network structures (Study 2). In the prediction of midseason task cohesion perceptions, the current study was able to capture and enter the network structure metrics at the respective level, and also break down the overall variance accounted for by the individual and group. In line with initial theorizing by Carron and colleagues (1998), it appeared that midseason task cohesion perceptions receive contributions in part from the individual athlete and group membership (e.g., unique culture of team communication).

Despite these strengths, it also is important to recognize the study's limitations. First, team performance scores operationalized as winning percentage were based on objective measures at each measurement period. While this could be considered a strength, it does not allow for a multilevel analysis because the measure was assessed at the team level. One possible future direction is to consider subjective team performance (e.g., team performance satisfaction; Riemer & Chelladurai, 1998), which is captured at the individual level. Obviously, following this approach assumes that teasing out the contributions at the individual and group level is an integral part of the research question.

Further, the item used to capture information exchange network structure asked individual members who they exchanged information with during the game. One limitation of this item is that it does not offer specificity as to who is, for example, the source of the

information. By considering additional ways to capture the social network in teams, future research can continue to build this relationship. If teams have few members from whom individuals seek information, it is possible that these members could be overloaded during a performance and overall team effectiveness could suffer. Further to this point, these data do not capture communication prior to, or after, competition and do not specify the type of information being exchanged (e.g., Hinsz et al., 1997). These additions to future study designs will aid in understanding more specifically how information exchange relates to cohesion and team performance.

Overall, the current study makes a contribution to the sport communication research base by constructively replicating (Huffmeier et al., 2016) the relationship between information exchange and the outcomes of task cohesion and team performance using a prospective field design with a nested sample of athletes on intact teams (Klein et al., 2014). When these findings are coupled with similar results reported across a number of different studies employing different samples and study designs (Studies 1, 2, 3, and 4), member communication as information exchange is suggested as one potential cue for cohesion. Also, this prospective study design tested relationships across the first half of a competitive season for basketball athletes. This is the temporal period that past research has identified as particularly important for the network structure of member communication before member coordination can begin to rely more on familiarity and routine (Balkundi & Harrison, 2006).

CHAPTER 6

GENERAL DISCUSSION

Group cohesion has been established as an important perception for athletes given its positive relationship with key individual- (e.g., adherence; Spink et al., 2010) and team-level outcomes (e.g., performance; Carron et al., 2002). Despite its acknowledged importance, less attention has been allocated to the way that athletes form their perceptions of cohesion. This is unfortunate as having a clear understanding as to the sources of information that athletes use to draw these perceptions would be of value. While there are different variables that may serve as potential cues for different aspects of cohesion at different points in group development (Carron & Brawley, 2000), the studies in this dissertation focused on member communication as one potential cue to task cohesion.

The results of Study 1 replicated and extended past findings based on social communication properties (i.e., acceptance, distinctiveness, positive conflict, and negative conflict; Sullivan & Short, 2011). It was found that information exchange—a functional communication property—predicted unique variance in task cohesion over and above the social forms of communication and resulted in a reallocation of the variance components from previously understood social properties (e.g., Kim et al., 2016; McLaren & Spink, 2018). The emergence of the relationship between information exchange and task cohesion created the underpinning for the remaining studies.

The following four studies built on these individual perception findings to explore information exchange from a social network perspective (Borgatti et al., 2013). As a dyad-based approach, social network analysis offered an opportunity to map out exactly which athletes were exchanging information. The findings from Study 2 captured the personal networks of each athlete (i.e., which teammates they reported exchanging information with on a regular basis) and found a network size-cohesion relationship where task cohesion perceptions increased as the size of an individual's information exchange network increased from smaller to moderate to larger. To complement this field study, a vignette-based approach was used in Study 3 to compare two hypothetical teams that not only differed in the degree to which individual members exchanged information, but also the degree to which the team as a whole exchanged information. The results revealed that higher information exchange at both the individual and team level was associated with higher anticipated task cohesion.

The final two studies were designed to replicate and extend the information exchange/task cohesion relationship emerging in Studies 1, 2, and 3 by generating the information exchange networks of intact sport teams. In Study 4, two intact teams competing in a head-to-head match were compared. The results revealed that the winning team had a communication network structure that featured higher individual and team level information exchanges as well as higher perceptions of task cohesion while controlling for task demands. A prospective study design was used in Study 5 to extend these findings in a larger sample of intact teams and included team performance as an outcome variable based on the Study 4 results. The results revealed that early season information exchange at the individual level significantly predicted midseason task cohesion perceptions while controlling for early season task cohesion. Further, early season information exchange at the team level significantly predicted midseason team performance while controlling for early season performance. A summary of the studies in this dissertation can be found in Table 6.1.

Table 6.1

Summary of Study Findings

	Sport Type	<i>n</i>	Study Design	Operationalization of Information Exchange	Dependent Variable(s)	Significant Findings	Gap Addressed Between Studies
Study 1	Multiple	180	Concurrent, online	Individual perception	GI-Task	↑ Information exchange ↑ GI-Task	Study 1 to 2: Limitation of individual perception measure
Study 2	Basketball teams	205	Concurrent, field	Social Network Analysis- individual outdegree centrality	GI-Task	↑ Information exchange network size ↑ GI-Task	
Study 3	Multiple	177	Experimental, online	Vignettes- individual degree centrality and network density	GI-Task	↑ Individual and team information exchange ↑ GI-Task	Study 2 to 3: Individual/team aspects of the information exchange network
Study 4	Soccer teams	26	Concurrent, field	Social Network Analysis- individual degree centrality and network density	Team performance	Winning team ↑ Information exchange ↑ GI-Task	Study 3 to 4: Actual network of intact teams and control for task demands
Study 5	Basketball teams	133	Prospective, field	Social Network Analysis- individual degree centrality and network density	GI-Task Team performance	↑ Individual exchange ↑ GI-Task ↑ Team exchange ↑ Team performance	Study 4 to 5: Prospectively test the relationships

6.1 Empirical Contributions to the Sport Literature

Together, the findings of the studies in this dissertation make important contributions to the sport communication and group cohesion literature in a number of different ways.

6.1.1 Communication as information exchange as a potential cue to task cohesion

Given the importance placed on group cohesion in the sport setting (e.g., Spink, 2016), better understanding the source of these perceptions is of value on a number of fronts. Conceptually, cohesion is viewed as dynamic, multidimensional, and captures both the instrumental and affective components of the group (Carron et al., 1985; Carron et al., 1998). As such, it is necessary that study designs and subsequent findings of cohesion research are mindful of these aspects. Further, different team processes and group characteristics can be important considerations for athletes in assessing cohesion (multidimensional) at different points in time of a group's development (dynamics) and can differentially relate to the task- (instrumental) or social-based (affective) components of the sport team.

One of the assumptions made in this dissertation concerned the fact that task-based member communication (i.e., information exchange) should best serve as a potential cue to individuals' perceptions of task cohesion. Attending to the dynamic aspect of cohesion, the relationship between information exchange and task cohesion was found at different points of group development across the current studies. For instance, the participants in Study 1 reported a range of personal experience with their team, participants in Studies 2 and 4 reported experiences near the end of a full competitive season, and those in Study 5 were capturing experiences earlier in group development across the first half of the season. As such, the results provide evidence that communication as information exchange may serve as a potential cue to task cohesion given the associations found across different single points in time for a team.

6.1.2 Communication as information exchange at the individual and team level

Studies 3 to 5 considered the degree to which individual members communicated with specific others as well as the degree to which the team as a whole communicated. This distinction aligned with Carron and colleagues' (e.g., Carron, Brawley, et al., 2002) suggestion that athletes will consider both their own personal experiences in the social situation of the team and the actual reality of the team as a whole when making an assessment of the degree to which the team is cohesive. This adds to past communication/cohesion research that has been based on athlete perceptions (e.g., Kim et al., 2016; McLaren & Spink, 2018; Sullivan & Short, 2011).

While informative, the results from these extant studies do not allow for specificity as to what the athlete is referencing when drawing these perceptions. Is it the athlete's personal interactions, the interactions of the team more generally, or some combination of the two? Making this distinction is instructive as it cannot be assumed the two sources are congruent. For instance, if an athlete does not interact with many others on the team but the pattern for the remainder of his/her teammates is higher interaction, cohesion could be impacted in a positive or negative direction. Without identification of these different levels, it is difficult to understand which source of information exchange is more associated with cohesion perceptions.

6.1.3 Other properties of member communication

As noted, past communication/cohesion research in the sport setting has focused on individual perceptions of the team (e.g., McLaren & Spink, 2018). As such, the majority of the research has tested the social properties of communication based on the instrument created by Sullivan and colleagues (i.e., SECTS, SECTS-2; Sullivan & Feltz, 2003; Sullivan & Short, 2011). However, as acknowledged by these researchers in their instrument development (Sullivan & Short, 2011) as well as other sport researchers (e.g., Eccles & Tenenbaum, 2004), functional components of member communication also are important in sport teams.

In Study 1, the findings demonstrated a significant relationship between member information exchange and task cohesion while controlling for the previously tested social properties of communication. This informational perspective was based on the theoretical stance that sport teams are information-processing units (e.g., Hinsz et al., 1997; Reimer et al., 2006). Competing against an opponent in a dynamic environment and coordinating actions for athletes with different roles requires the exchange of information between appropriate members in real time. The social properties of communication captured in acceptance, distinctiveness, positive conflict, and negative conflict do not reflect this informational process.

6.1.4 Information exchange and team performance in sport

In addition to task cohesion as an outcome of information exchange, a secondary purpose of this research captured in Studies 4 and 5 was team performance. Although the relationship between information exchange (including networks structure) and team performance has been well established in other task-based group settings (e.g., work teams; Balkundi & Harrison, 2006; DeChurch & Mesmer-Magnus, 2010), this relationship had not yet been tested in the context of sport. In this dissertation, two different designs featured performance. In Study 4,

team performance (i.e., win/loss) was considered as an outcome to test for differences between information exchange network structure and task cohesion. Although the relationship between cohesion and team performance has been documented in sport (Carron, Colman, et al., 2002), the finding for information exchange network structure was new.

In the final study of this dissertation (Study 5), the networks structure was compiled from a number of different intact sport teams. Although the individual exchange behaviours assessed earlier in the season did not relate to the objective performance score of the team at midseason, the way the team as a whole exchanged information significantly predicted team performance. Using network density as a social network metric, a higher number of overall exchanges between all members was related moderately to a higher team winning percentage.

6.2 Methodological Contributions to the Sport Literature

6.2.1 Constructive replication of communication as a potential cue to cohesion

A constructive replication is a study that serves not only to replicate past findings, but also to include a new element that refines or extends the current understanding (Huffmeier et al., 2016). Across the studies in this dissertation, the relationship between communication and task cohesion was replicated and extended with different measurement tools (i.e., individual perceptions, social network structure), samples (e.g., team sport athletes, intact sport teams), and study designs (e.g., cross-sectional, prospective, hypothetical vignettes). In each study, preliminary evidence for communication as a potential cue to cohesion was built upon through laboratory- and field-based research. To set the baseline, it was necessary to establish that communication as information exchange accounted for variance in task cohesion over and above the existing conceptualization of communication as being social in nature (Sullivan & Short, 2011), which was done in Study 1.

6.2.2 Social network analysis in sport teams

The use of social network analysis in this dissertation offered the descriptive ability to model actual social relations between team members (Borgatti et al., 2013). In this case, the social relation was members who exchanged information on a regular basis (Study 2) or in a specific game (Studies 4 and 5). This moved the communication measurement focus away from the perceptions of the individual, which lacks a certain amount of specificity as to who exactly is involved in the act of information exchange. In Study 2, the personal (ego) information exchange networks of team sport athletes were generated, and it was found that as the size of an athlete's

network increases in proportion their perceptions of task cohesion were higher. In addition to isolating the personal network of each individual on a team, social network analysis allows for these networks to be compiled in a way that provides an overview of the team as a whole. In terms of communication, mapping out the information exchange behaviours of an individual can then be considered in light of the way the rest of the team exchanges information.

6.2.3 Hypothetical vignette manipulation

A final methodological contribution of this dissertation was the use of hypothetical vignettes to manipulate the communication processes of two sport teams (Study 3). Moreover, these vignettes were crafted to contain a visual graphic of a communication network that corresponded to the text description, which also was novel to the sport literature. While this approach has been used in broader organizational contexts (e.g., Brands et al., 2015; Mehra et al., 2012), it is the first time that such an approach has been used to describe a hypothetical sport team. While some opponents of vignette research cite limitations to external validity (Atzmüller & Steiner, 2010), the consistency of the findings in Study 3 to the field studies examined in this dissertation where external validity was higher (Studies 2 and 5) countered this potential weakness where higher internal validity was the purpose. In Study 3, participants were randomly assigned to read about a team that varied in the way athletes exchanged information. One team engaged in higher exchange at the individual and team level while the comparison team engaged in lower exchange at the individual and team level. If differences existed, it was assumed that this would be captured using groups that vary the most in the team process of communication. A vignette-based methodology allowed for the testing of this possibility at the team level given that Study 2 was focused only on personal exchange networks.

6.3 Limitations and Future Directions

6.3.1 Generalizability

Despite the fact that the studies in the current dissertation sampled team sport athletes generally (Studies 1 and 3), basketball teams (Studies 2 and 5), and soccer teams (Study 4), there remains limitations as to the generalizability of the findings. Especially in Studies 2, 4, and 5, the sample was composed primarily of male athletes of smaller (versus larger) interdependent sport teams from competitive adult sport leagues. While this male/female difference mirrored the relative participation rates in the respective sport leagues, the results of this dissertation must be interpreted with these boundary conditions in mind.

Future direction. To increase the generalizability of these findings, future research should consider sampling athletes in two other ways. First, group size has been identified as a correlate of group cohesion in past research (e.g., Widmeyer et al., 1990). One potential reason for the decrease in cohesion as group size increases could be a greater difficulty in communication between members. This begs the question of whether the information exchange network structure/task cohesion relationship changes for larger sport teams (e.g., football, hockey). An additional consideration relative to generalizability would be the extension to independent sport types in which less communication is required between members to carry out required tasks (e.g., a golf team; Evans et al., 2012).

6.3.2 Nature of information exchange

A second limitation of the current studies in this dissertation is the generality that was applied to information exchange. While this suited the preliminary nature of this research, it carried the limitation as to what specifically was being exchanged with different teammates (see Hinsz et al., 1997), and speaks to the quantity versus quality of member communication. For Studies 2, 3, 4, and 5, participants were prefaced with a brief paragraph that spoke to communication being important for members of a team to coordinate their actions and work together as a team. However, it was not specific as to the types of information that may have been exchanged (e.g., Marks et al., 2001). In addition to the content of information exchanges, research questions in the current studies related to the quantity of information exchange as opposed to the quality of exchanges. If athletes exchanged information with fewer members, but those interactions were of high quality and gave an athlete the required information, it may be possible to perceive higher task cohesion. Further, the use of the term exchange to describe information transferring from one member of a team to another may have been problematic. While use of the term was consistent with conceptual and operational definitions (see Study 1), it is possible that some ambiguity could arise if the athlete assumes that exchange infers a reciprocal transaction.

Future directions. Using social network analysis, one consideration for future researchers will be to quantify the quality of information exchange between members as opposed to simply reporting the presence/absence of these connections. This could extend the individual/team interface related to cohesion perceptions in different ways. For instance, the overall network of information exchange for a team could better be understood as a dense

network of high-quality exchanges or a dense network of lower-quality interactions, which then could be related to cohesion perceptions. Also, terms to replace ‘exchange’ of information could include specific indicators such as sending information to and receiving information from a teammate.

6.3.3 Other future directions

Three other future directions emerged based on the findings of the studies in this dissertation. The first involves examining the level of consensus achieved in information exchange for the athletes on an intact sport team (e.g., Carron et al., 2003). If the individuals on a team engage in similar amounts of information exchange, are perceptions of task cohesion higher compared with a team that has a lower consensus? While the results of this study can speak tangentially to this potential future research question (i.e., teams with higher density have members that all communicate to a higher degree), they are unable to provide any insight into what happens for teams who exhibit a lower density but have consensus on the actual amount of information exchange per member.

Second, the information exchange networks captured in this dissertation were focused on communication during competition. However, it is likely that a great deal of information exchange also happens in the preparation and reflection phases surrounding competition. While overlap is likely, one option for future research would be to create separate networks for each of the three phases and test the predictive value of network structure in relation to cohesion or performance. In addition, ensuring that information exchange is assessed over time (not game specific) might align better with the focus of group cohesion perceptions, which are measured at a more general level as opposed to a single point in time.

Third, Study 1 tested the relationship between information exchange and task cohesion while controlling for the variance accounted for by social communication properties. In the remaining studies, the social properties of communication were not considered in the design. It may be of value in future research to consider the potential interplay between team members exchanging information as well as the way that teammates typically communicate (i.e., social communication properties) with one another. For instance, does the presence of higher positive versus higher negative conflict communication between members strengthen the information exchange/cohesion relationship? Possibly, members who are communicating in a positive way

about conflict may be less likely to let disagreements keep them from communicating versus those who use more negative conflict communication.

Finally, Studies 1, 4, and 5 used a measure of team performance that focused on games won (e.g., winning percentage). While this is an accepted way to capture team performance, it is possible that some of the meaning associated with performance could be lost in this operationalization. For instance, it has been known for some time that winning and losing may not be the same as success and failure (Spink & Roberts, 1980). That is, feeling successful could vary as a function of performance expectations. For instance, it is possible that the members of a team that does not win, but feel the team played well and accomplished its goals will feel successful. As such, considering ways to operationalize team performance other than winning percentage would benefit future research examining the relationships between performance and communication as information exchange.

6.4 Conclusion

Cohesion has been established as a critical variable in group dynamics research. It is so central that it has been called the most important variable for small groups (e.g., Lott & Lott, 1965). What is less understood are the specific variables that contribute to cohesion perceptions. Relevant to this dissertation, member communication as information exchange was examined as one source of information that might be related to and possibly form perceptions of task cohesion.

Although preliminary in nature, the results of the current dissertation represent an initial insight into information exchange as a potential cue to the group component of task cohesion. While more research is needed to replicate these findings, the consistency demonstrated across complementary study designs, participant samples, and measurement tools is a promising starting point from the perspective of individual- and team-level communication as information exchange. Based on the results demonstrated, estimates of group task cohesion appear to be associated with the source of information provided by a team of athletes exchanging information with one another to a high degree.

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Appendix A: Study 1 Recruitment Material

PAWS Recruitment Advertisement

Title = Are you a team sport athlete?

We are looking for team sport athletes (18 years and older) who are interested in taking part in a brief online research study. The aim of this study is to understand team processes and perceptions of the environment on adult sport teams.

Participation in this study involves completing an online survey where you will be asked to respond to a series of questionnaires while thinking about your sport team. The survey will take approximately 15 minutes to complete. Your responses will be anonymous, such that the researchers will not be able to identify you.

We are specifically looking for individuals who:

(a) hold at least 1 year of experience playing your sport, and

(b) have been a member of a recreational or competitive team within the past year (or are currently competing on a team).

Participants who complete all portions of the study will have a chance to be entered into a draw for **1 of 4** \$50 gift cards for Tim Horton's. Your participation in this research study is much appreciated!

If you are interested in participating, please go to <enter survey url here>

Thank you!

Colin D. McLaren, Ph.D. Candidate
Kevin S. Spink, Ph.D.
College of Kinesiology
University of Saskatchewan

Twitter Recruitment

Please RT! Seeking team sport athletes 18+ for 15min online survey re: team processes and perceived environment <enter survey url here>

Appendix B: Study 1 Participant Consent Form

You are invited to participate in a research study involving adults (18 years and older). Please read this form carefully. If you have any questions now or during the study, please feel free to contact the researchers via email or phone using the information listed below. This study forms a portion of the researchers' overall program of research examining groups.

Project Title: Team cognition in sport: Testing the relationship between group processes and the group environment

Survey link: <Insert Fluid Survey link to the questionnaire here>

Researchers:

Colin D. McLaren

Ph.D. Candidate

College of Kinesiology

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Professor

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Purpose: In this study, we are interested in examining participant's perceptions about their team processes (i.e., communication and coordination practices) and the team environment (i.e., cohesion, groupness, and psychological climate).

Procedure: Your participation will involve responding to a series of questionnaires that pertain to team processes and the perceived team environment of your current sport team. The total time commitment for completing the survey is approximately 15 minutes. If you choose to participate, anonymity is assured, meaning that your identity will not be linked to your responses.

Potential Benefits: All participants will be entered to win 1 of 4 \$50 Gift Cards from Tim Horton's once all portions of the study have been completed. As a participant, you may be making important contributions to the research literature. There are no personal benefits to participating in this study, although the findings from this study will help sport psychology researchers to better understand team cognition in sport.

Potential Risks: Participation in this study presents no anticipated risks.

Storage of Data: This survey is hosted by Fluid Survey™ a company located in the USA and subject to US laws and whose servers are located outside of Canada. The privacy of the information you provide is subject to the laws of those other jurisdictions. By participating in this survey you acknowledge and agree that your information will be stored and accessed outside of Canada and may or may not receive the same level of privacy protection. Electronic data will be copied to an external drive and will be locked by password in read-only format. Only the researchers will have access to the data. No data will be stored on any computer hard drives once the study is complete. This data will also be backed up using the University of Saskatchewan secure cabinet on PAWS. The data will be stored for a minimum of five years after completion of the study. If the researcher chooses to

destroy the data after the five years, it will be destroyed beyond recovery. This is standard protocol for any data that may be published in an academic journal or presented at a professional conference.

Confidentiality: Steps will be taken to ensure confidentiality. You will not be required to provide your name during any portion of the online survey, and therefore your responses will be anonymous and only be identified with an assigned participant ID. In relation to participant compensation, those wishing to be entered into the draw will be redirected to a new page whereby email addresses can be collected. This ensures that personal information cannot be linked to survey responses. At this time, you will also be able to indicate if you would like to be contacted directly regarding future online studies in this research program. Please be aware that that if you choose to retweet our advertisement with subscribers to your social media account, it is possible that these individuals may assume you have participated in the online study. When published or presented at conferences, the data will be reported in a summarized form so that it will not be possible to identify responses from individual participants.

Right to Withdraw: Your participation in this study is voluntary and you are free to answer only the questions that you are comfortable answering. You may withdraw from the research project prior to survey completion for any reason, without penalty of any sort. If you withdraw from the study before survey completion, any data that you have contributed will be destroyed. However, once you have submitted your survey responses, it will no longer be possible to withdraw your data as your responses are anonymous.

Questions: If you have any questions concerning the research project, please feel free to contact the researchers at any time using the phone numbers/email addresses provided above. This research project has been approved on ethical grounds by the University of Saskatchewan Research Ethics Board. Any questions regarding your rights as a participant may be addressed to that committee through the Research Ethics Office (ethics.office@usask.ca or 306- 966-2975). Out of town participants may call toll-free (888-966-2975).

Study Results: Data from this study will be used for completion of Colin McLaren's PhD thesis, may be published in an academic journal, or presented at a professional conference. If you would like a summary of the findings from this study, please email the primary researcher (kevin.spink@usask.ca). Or, you can check the box on the redirected page in the online survey that offers a chance to provide your e-mail. This is the same page in which you can enter the gift card draw.

Consent to Participate:

By completing and submitting the questionnaire, **YOUR FREE AND INFORMED CONSENT IS IMPLIED** and indicates that you understand the above conditions of participation in this study. **We recommend that you print a copy of this form for your records.**

I consent to participate in the research project. The chance to print a copy of this Consent Form has been provided to me for my records.

Yes
No

Appendix C: Study 1 Participant Questionnaire

Demographic Questionnaire

The following questions are designed to allow us to find out about those who completed the survey as well as their sport-related experiences.

- 1) What is your age (in years)? _____
- 2) What is your gender? _____

While you may compete in more than one sport, please choose only one and complete the remainder of this study with that team in mind.

- 3) Indicate the sport you currently compete in _____
- 4) What is the highest competitive level of this sport you have played (choose the option that best applies)? intramural, recreational, club, competitive, university, provincial, national, international, other
- 5) In which division do you compete (choose all that apply)? male only female only co-ed
- 6) How many years have you played this sport? _____
- 7) How many years have you played on/with your specific team? _____
- 8) Describe your starting status (choose the option that best applies): Starter Non-starter Practice Player

Please fill out this questionnaire in one sitting without consulting with others.

Team Performance

	Wins very few games					Wins most games	
	1	2	3	4	5	6	7
How many games does your team typically win							

Team Processes

The following items are concerned with how players on your team (and only the players) usually communicate with each other. They refer to any situation in which the team interacts, not just games or practices. Read each question and answer honestly.

Cooperative Communication Scale (From Lee, 1997)

Indicate the degree to which you agree with the following items:

	Strongly Disagree			Strongly Agree	
	1	2	3	4	5
1. Relevant information is exchanged openly among team members					
2. In general, it is difficult to approach other team members					

3. Team members often criticize other team members	1	2	3	4	5
4. Some individuals on my team intentionally provide misleading information to others	1	2	3	4	5
5. If disagreements arise, group members are usually able to solve them	1	2	3	4	5
6. My team members openly share their ideas with other team members	1	2	3	4	5
7. My team members often fail to communicate information to each other	1	2	3	4	5

Intra-team communication (From Sullivan & Short, 2011)

Consider the how often your team uses the following types of communication:

Answer using this scale:

<i>Hardly ever</i>						<i>Almost always</i>
1	2	3	4	5	6	7

When our team communicates, we . . .

1. use nicknames	1	2	3	4	5	6	7
2. shout when upset	1	2	3	4	5	6	7
3. get all problems out in the open	1	2	3	4	5	6	7
4. trust each other	1	2	3	4	5	6	7
5. try to communicate directly with those with whom we have a problem	1	2	3	4	5	6	7
6. communicate our feelings honestly	1	2	3	4	5	6	7
7. use slang that only team members would understand	1	2	3	4	5	6	7
8. get in "each other's faces" when we disagree	1	2	3	4	5	6	7
9. use gestures that only team members would understand	1	2	3	4	5	6	7
10. communicate anger through body language	1	2	3	4	5	6	7
11. share thoughts with one another	1	2	3	4	5	6	7
12. show that we lose our temper	1	2	3	4	5	6	7
13. are willing to discuss our feelings	1	2	3	4	5	6	7
14. try to make sure all players are included	1	2	3	4	5	6	7
15. compromise with each other when we disagree	1	2	3	4	5	6	7

Group Cohesion- Positively-worded version (Eys et al., 2007) of the Group Environment Questionnaire (Carron et al., 1985)

This questionnaire is designed to assess your perceptions of your team. There are no wrong or right answers, so please give your immediate reaction. Some of the questions may seem repetitive, but please answer ALL questions.

The following statements are designed to assess your perceptions of YOUR TEAM AS A WHOLE. Please circle a number from 1 to 9 to indicate your level of agreement with each of these statements.

1. Our team is united in trying to reach its goals for performance

1	2	3	4	5	6	7	8	9
Strongly Disagree								Strongly Agree

1 2 3 4 5 6 7 8 9
Strongly Disagree Strongly Agree

1	2	3	4	5	6	7	8	9
Strongly Disagree							Strongly Agree	

1	2	3	4	5	6	7	8	9
Strongly Disagree							Strongly Agree	

1 2 3 4 5 6 7 8 9
Strongly Disagree Strongly Agree

Appendix D: Study 2 Recruitment Letter for Team Representatives

Hello Captains,

My name is Colin McLaren and I am a PhD Candidate at the University of Saskatchewan in the College of Kinesiology. I am doing a research study looking at team communication networks and their relationship to team cohesion, and I am interested in recruiting participants who play on teams in the [league]. The study involves having the players on teams who volunteer complete a short questionnaire (5-10 minutes) following a game sometime near the end of this season. Participants will list the members on the team they communicate with, as well as their perceptions of the team cohesion. All information obtained will be kept confidential.

I am wondering if you would allow me to seek participation from the members of your basketball team for my study. I would be collecting data before the final game of the regular season, which will range based on your specific schedule. It is important to note that whether or not a team decides to participate in the study will have no bearing on how teams or individuals are treated within the [league], now, or in the future.

If you are interested, please e-mail me (at the address below). At that time, we can also set up a time for me to attend a game to administer the survey package. All participants will have the opportunity to enter a draw for 1 of 5 \$20 Tim Horton's gift cards upon completion.

Your assistance and consideration is greatly appreciated.

Colin McLaren
colin.mclaren@usask.ca
306-514-0416
Supervisor: Kevin S. Spink, Ph.D.

Appendix E: Study 2 Recruitment Script for Athletes

Hello,

My name is Colin McLaren and I am a PhD Candidate at the University of Saskatchewan in the College of Kinesiology. I am doing a research study looking at team communication networks and their relationship to team cohesion in sport teams. Your involvement in this study today would include completing a short questionnaire (5-10 minutes) where you will be asked about which members on your team you communicate with, and your perceptions of team cohesion.

All information obtained today will be kept confidential, and you can withdraw from the study at any time. Importantly, whether or not you decide to participate in the study will have no bearing on how you, or your team, are treated within the [league] now, or in the future. All participants will have the opportunity to enter a draw for 1 of 5 \$20 Tim Horton's gift cards upon completion.

Thank you for your consideration and participation.

Appendix F: Study 2 Participant Consent Form

You are invited to participate in a research study involving adults (18 years and older). Please read this form carefully. If you have any questions now or during the study, please feel free to ask the researchers directly, or contact the researchers via email or phone using the information listed below. This study forms a portion of the researchers' overall program of research examining groups.

Project Title: Team communication networks: Cognition as a cue for group cohesion and performance

Researchers:

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Dr. Kevin S. Spink

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Purpose: In this study, we are interested in examining team communication networks and its relationship to important team sport outcomes (i.e., team cohesion and performance).

Procedure: Your participation will involve responding to a series of questionnaires that pertain to team processes and the perceived team environment of your current team. The total time commitment for completing the survey is approximately 10 minutes. If you choose to participate, confidentiality is assured in that only the researchers will be able to link your identity to your responses.

Potential Benefits: As a participant, you may be making important contributions to the research literature. There are no personal benefits to participating in this study, although the findings from this study will help sport psychology researchers to better understand team cognition in sport.

Potential Risks: Participation in this study presents no anticipated risks.

Storage of Data: Electronic data will be copied to an external drive and will be locked by password in read-only format. Only the researchers will have access to the data. No data will be stored on any computer hard drives once the study is complete. This data will also be backed up using the University of Saskatchewan secure cabinet on PAWS. The data will be stored for a minimum of five years after completion of the study. If the researcher chooses to destroy the data after the five years, it will be destroyed beyond recovery. This is standard protocol for any data that may be published in an academic journal or presented at a professional conference.

Confidentiality: Steps will be taken to ensure confidentiality. You will not be required to provide your name on the survey, only your specific uniform number as part of a unique identification number. Further, after all responses are tabulated, all names from the social network items names will be replaced with the unique participant ID codes such that participant names could not possibly be identified. While every effort will be taken to maintain member

confidentiality, there are limits on the level of confidentiality that the researcher can assure. Because members will be identifying teammates for some questions, it is possible that teammates might become aware of who was and was not listed. The researcher will safeguard the confidentiality of these lists, but cannot guarantee that other members of the team will do so. Please respect the confidentiality of your teammates by not disclosing your lists both inside and outside of the team, and be aware that teammates may not respect your confidentiality. Your consent form, responses, and the Master Lists containing all names and unique identification numbers will be stored separately, and any data reported will be aggregated such that individual responses are not identifiable.

Right to Withdraw: Your participation in this study is voluntary and you are free to answer only the questions that you are comfortable answering. Also, you may return a blank questionnaire package in the envelope if you wish not to participate after reading this consent form. You may withdraw from the research prior to survey completion for any reason, without penalty of any sort. If you withdraw from the study before survey completion, any data that you have contributed will be destroyed. However, once you have submitted your survey responses, the right to withdraw will extend to May 31, 2017. After this date, it is likely that some study results will have already been disseminated, and it may not be possible to withdraw your data.

Questions: If you have any questions concerning the research project, please feel free to contact the researchers at any time using the phone numbers/email addresses provided above. This research project has been approved on ethical grounds by the University of Saskatchewan Research Ethics Board. Any questions regarding your rights as a participant may be addressed to that committee through the Research Ethics Office (ethics.office@usask.ca or 306- 966-2975). Out of town participants may call toll-free (888-966-2975).

Study Results: Data from this study will be used for completion of Colin McLaren's PhD thesis, and may be published in an academic journal, or presented at a professional conference. If you would like a summary of the findings from this study, please email the primary researcher (kevin.spink@usask.ca). Or, you can check the box on the study compensation page that offers a chance to provide your e-mail. This is the same page where you can enter the gift card draw.

Compensation: All participants will have the opportunity to enter a draw to win 1 of 5 \$20 Gift Cards from Tim Horton's once all portions of the study have been completed.

Consent to Participate:

Your signature below indicates that you have read and understand the description provided. I have had an opportunity to ask questions and my questions have been answered. I consent to participate in the research project. A copy of this Consent Form has been given to me for my records.

_____ Name of Participant	_____ Signature	_____ Date
_____ Researcher's Signature		_____ Date

Appendix G: Study 2 Participant Questionnaire

Demographic Questionnaire

The following questions are designed to allow us to find out about those who completed the survey as well as their sport-related experiences.

What is your age (in years)? _____

What is your gender? _____

How many years have you played basketball? _____

How many years have you played on/with your specific team? _____

How many years have you played in the [league]? _____

What position(s) do you primarily play? _____

Describe your starting status (choose the option that best applies): Starter Non-starter
Practice Player

Group Cohesion- Positively-worded version (Eys et al., 2007) of the Group Environment Questionnaire (Carron et al., 1985)

The following statements are designed to assess your perceptions of YOUR TEAM AS A WHOLE. Please circle a number from 1 to 9 to indicate your level of agreement with each of these statements.

1. Our team is united in trying to reach its goals for performance

1	2	3	4	5	6	7	8	9
---	---	---	---	---	---	---	---	---

Strongly Disagree

Strongly Agree

2. We all take responsibility for any loss or poor performance by our team

1 2 3 4 5 6 7 8 9

Strongly Disagree

Strongly Agree

3. Our team members have similar aspirations for the team's performance

1 2 3 4 5 6 7 8 9

Strongly Disagree

Strongly Agree

4. If members of our team have problems in practice, everyone wants to help them so we can get back together again

1	2	3	4	5	6	7	8	9
---	---	---	---	---	---	---	---	---

Strongly Disagree

Strongly Agree

5. Our team members communicate freely about each athlete's responsibilities during competition or practice

1	2	3	4	5	6	7	8	9
---	---	---	---	---	---	---	---	---

Strongly Disagree

Strongly Agree

Social Network

Team sport is unique in that teammates must coordinate their actions to be successful. This can be seen in the way that teammates communicate with one another. These communications involve the sharing of knowledge, information, or ideas. We would like you to think about the members on your team as you answer the following questions. For each question, you can select as little as no members or as high as all members. Please place a checkmark under the name of each member you regularly share knowledge and information with during a game (do not select yourself).

	[Enter name here]	[Enter name here]	[Enter name here]	[Enter name here]	[Enter name here]	[Enter name here]	[Enter name here]	[Enter name here]	[Enter name here]	[Enter name here]	[Enter name here]	[Enter name here]
1. I openly exchange information with these team members												

Appendix H: Study 3 Recruitment Material

PAWS Recruitment Advertisement

Title = Are you a team sport athlete?

We are looking for team sport athletes (18 years and older) who are interested in taking part in a brief online research study. The aim of this study is to understand team processes and perceptions of the environment on adult sport teams.

Participation in this study involves completing an online survey where you will be asked to read about a hypothetical sport team and respond to a series of questions while thinking about that team. The survey will take approximately 10 minutes to complete. Your responses will be anonymous, such that the researchers will not be able to identify you.

We are specifically looking for individuals who:

(a) hold at least 1 year of experience playing your sport, and

(b) have been a member of a recreational or competitive team within the past year (or are currently competing on a team).

Participants who complete all portions of the study will have a chance to be entered into a draw for **1 of 5 \$20** gift cards for Tim Horton's. Your participation in this research study is much appreciated!

If you are interested in participating, please go to <enter url here>.

Thank you!

Colin D. McLaren, Ph.D. Candidate
Kevin S. Spink, Ph.D.
College of Kinesiology
University of Saskatchewan

Twitter Recruitment

Please RT! Seeking team sport athletes 18+ for 10min online survey re: team processes and perceived environment <enter url here>.

Appendix I: Study 3 Participant Consent Form

You are invited to participate in a research study involving adults (18 years and older). Please read this form carefully. If you have any questions now or during the study, please feel free to contact the researchers via email or phone using the information listed below. This study forms a portion of the researchers' overall program of research examining groups.

Project Title: Team communication in sport: Experimental effects on group cohesion

Survey link: <enter url here>.

Researchers:

Colin D. McLaren

Ph.D. Candidate

College of Kinesiology

University of Saskatchewan

Tel: (306) 966-1099

Email: colin.mclaren@usask.ca

Dr. Kevin S. Spink

Professor

College of Kinesiology

University of Saskatchewan

Tel: (306) 966-1074

Email: kevin.spink@usask.ca

Purpose: In this study, we are interested in examining participant's perceptions about a hypothetical sport team that has a specific team communication network.

Procedure: Your participation will involve reading a description of a sport team, then responding to a series of questions about that team. The total time commitment for completing the survey is approximately 10 minutes. If you choose to participate, anonymity is assured, meaning that your identity will not be linked to your responses.

Potential Benefits: All participants will be entered to win 1 of 5 \$20 Gift Cards from Tim Horton's once all portions of the study have been completed. As a participant, you may be making important contributions to the research literature. There are no personal benefits to participating in this study, although the findings from this study will help sport psychology researchers to better understand team cognition in sport.

Potential Risks: Participation in this study presents no anticipated risks.

Storage of Data: This survey is hosted by Fluid Survey™ a company located in the USA and subject to US laws and whose servers are located outside of Canada. The privacy of the information you provide is subject to the laws of those other jurisdictions. By participating in this survey you acknowledge and agree that your information will be stored and accessed outside of Canada and may or may not receive the same level of privacy protection. Electronic data will be copied to an external drive and will be locked by password in read-only format. Only the researchers will have access to the data. No data will be stored on any computer hard drives once the study is complete. This data will also be backed up using the University of Saskatchewan secure cabinet on PAWS. The data will be stored for a minimum of five years after completion of the study. If the researcher chooses to destroy the data after the five years, it will be destroyed beyond recovery. This is standard protocol for any data that may be published in an academic journal or presented at a professional conference.

Confidentiality: Steps will be taken to ensure confidentiality. You will not be required to provide your name during any portion of the online survey, and therefore your responses will be anonymous and only be identified with an assigned participant ID. In relation to participant compensation, those wishing to be entered into the draw will be redirected to a new page whereby email addresses can be collected. This ensures that personal information cannot be linked to survey responses. At this time, you will also be able to indicate if you would like to be contacted directly regarding future online studies in this research program. Please be aware that if you choose to retweet our advertisement with subscribers to your social media account, it is possible that these individuals may assume you have participated in the online study. When published or presented at conferences, the data will be reported in a summarized form so that it will not be possible to identify responses from individual participants.

Right to Withdraw: Your participation in this study is voluntary and you are free to answer only the questions that you are comfortable answering. You may withdraw from the research project prior to survey completion for any reason, without penalty of any sort. If you withdraw from the study before survey completion, any data that you have contributed will be destroyed. However, once you have submitted your survey responses, it will no longer be possible to withdraw your data as your responses are anonymous.

Questions: If you have any questions concerning the research project, please feel free to contact the researchers at any time using the phone numbers/email addresses provided above. This research project has been approved on ethical grounds by the University of Saskatchewan Research Ethics Board. Any questions regarding your rights as a participant may be addressed to that committee through the Research Ethics Office (ethics.office@usask.ca or 306- 966-2975). Out of town participants may call toll-free (888-966-2975).

Study Results: Data from this study will be used for completion of Colin McLaren's PhD thesis, may be published in an academic journal, or presented at a professional conference. If you would like a summary of the findings from this study, please email the primary researcher (kevin.spink@usask.ca). Or, you can check the box on the redirected page in the online survey that offers a chance to provide your e-mail. This is the same page in which you can enter the gift card draw.

Consent to Participate:

By completing and submitting the questionnaire, **YOUR FREE AND INFORMED CONSENT IS IMPLIED** and indicates that you understand the above conditions of participation in this study. **We recommend that you print a copy of this form for your records.**

I consent to participate in the research project. The chance to print a copy of this Consent Form has been provided to me for my records.

Yes
No

Appendix J: Study 3 Questionnaire and Vignettes

Demographic Questionnaire

The following questions are designed to allow us to find out about those who completed the survey as well as their sport-related experiences.

- 1) What is your age (in years)? _____
- 2) What is your gender? _____

While you may compete in more than one sport, please choose only one and complete the remainder of this study with that team in mind.

- 3) Indicate the sport you currently compete in _____
- 4) What is the highest competitive level of this sport you have played (choose the option that best applies)? intramural, recreational, club, competitive, university, provincial, national, international, other
- 5) In which division do you compete (choose all that apply)? male only female only co-ed
- 6) How many years have you played this sport? _____
- 7) How many years have you played on/with your specific team? _____
- 8) Describe your starting status (choose the option that best applies): Starter Non-starter Practice Player

Please fill out this questionnaire in one sitting without consulting with others.

Common Introduction to the vignettes

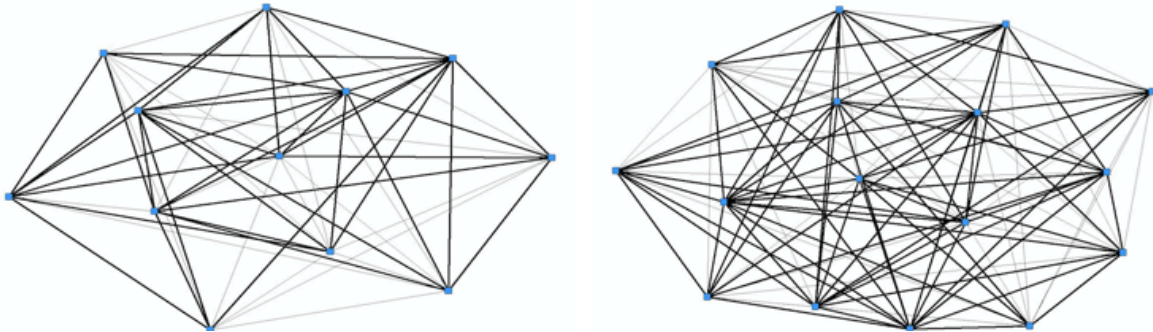
You will now read about a hypothetical {{ type }} team and be presented with an image (called a network) of who the players on the team communicate with on a regular basis.

In this network, each team member is represented by a small square, and the line between the members (squares) means that the members typically communicate. A thick line means that the two teammates provide knowledge, information, and resources to each other. A thin line means that knowledge, information, and resources is only going in one direction. Teammates who are at the center of the network are those who interact with many others on a regular basis (more influential for the movement of knowledge, information, and resources). This network not only indicates how many teammates an individual regularly communicates with, but also who those teammates regularly communicate with as well.

Higher individual centrality/higher density (12-member graphic on left, 16-member on the right)

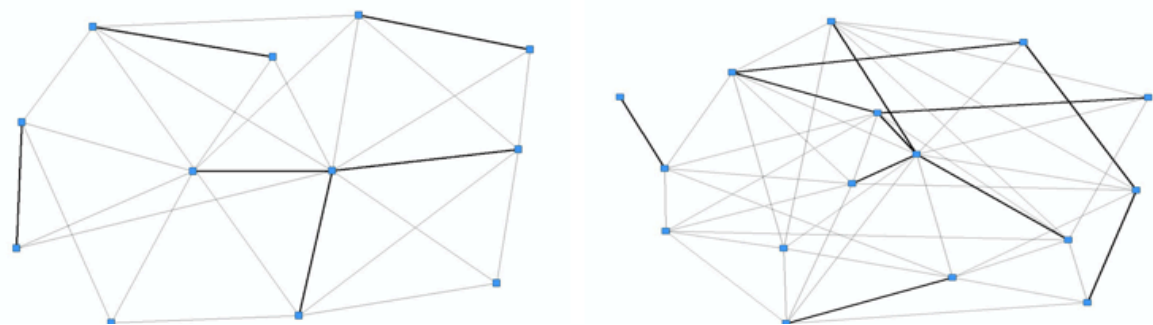
As you can see below, individuals on this {{ type }} team typically communicate with many other teammates, and a large majority of these communications go both ways (thick lines). There are a large number of individuals who find themselves in the center of the network, meaning that they have the opportunity to share knowledge, information, and resources with many teammates.

In terms of the overall communication network for this {{ type }} team, you can see that individuals not only communicate regularly with a high number of teammates, but those they are communicating with also communicate regularly with many others.



Lower individual centrality/lower density (12-member graphic on the left, 16-member on the right)

As you can see below, individuals on this {{ type }} team typically communicate with a few other members, and a large majority of these communications only go one way (thin lines). Only a small number of individuals find themselves in the center of the network, meaning that few have the opportunity to share knowledge, information, and resources with many teammates. In terms of the overall communication network for this {{ type }} team, you can see that individuals typically communicate regularly with only a few other teammates, and those they are communicating with also communicate regularly with only a few others.



Common preamble to the task cohesion measure

This network of teammate communications has emerged as a result of the experiences of this {{ type }} team early in the competitive season. We would like you to imagine what it would be like to be a member of this team. If this pattern of communication between members continued throughout the season, keeping this in mind, please answer the following questions:

Revised Group Environment Questionnaire (Carron et al., 1985)
Positively-worded version (Eys et al., 2007)- Group Integration-Task Scale

The following statements are designed to assess your perceptions of THE DESCRIBED TEAM AS A WHOLE. Thinking about the team communication network, please circle a number from 1 to 9 to indicate your level of agreement with each of these statements.

- | | | | | | | | | | |
|---|---|---|---|---|---|---|-----------------------|---|--|
| 1. This team would be united in trying to reach its goals for performance | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| Strongly Disagree | | | | | | | Strongly Agree | | |
| 2. Members of this team would all take responsibility for any loss or poor performance by our team | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| Strongly Disagree | | | | | | | Strongly Agree | | |
| 3. Team members would have similar aspirations for the team's performance | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| Strongly Disagree | | | | | | | Strongly Agree | | |
| 4. If members of this team had problems in practice, everyone would want to help them so they could get back together again | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| Strongly Disagree | | | | | | | Strongly Agree | | |
| 5. Team members would communicate freely about each athlete's responsibilities during competition or practice | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| Strongly Disagree | | | | | | | Strongly Agree | | |

Manipulation Check Questions

Based on the way the members of this team communicate, indicate the degree to which you believe the following items apply:

- | | Strongly Disagree | 2 | 3 | 4 | Strongly Agree |
|---|-------------------|---|---|---|----------------|
| 1. Relevant information is exchanged openly among team members | 1 | 2 | 3 | 4 | 5 |
| 2. If disagreements arise, group members are usually able to solve them | 1 | 2 | 3 | 4 | 5 |
| 3. My team members openly share their ideas with other team members | 1 | 2 | 3 | 4 | 5 |

Now, please think about the team communication network descriptions more generally:

Scale of 1 (strongly disagree) to 9 (strongly agree)

1. The information on the described team made sense to you
2. The information on the described team was believable
3. The team description was easy to read

Based on the way this team communicates, were you able to imagine the team that was described? [Scale of 1 (not at all) to 9 (very much so)]

The members of the team you read about typically communicated with:

- Many others
- Few others
- Not sure

Appendix K: Pilot Study Vignettes

Higher information exchange

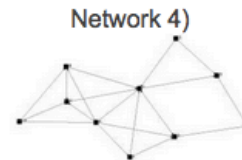
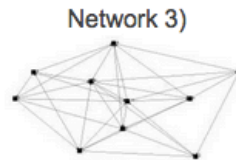
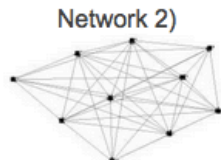
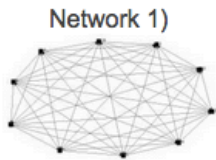
The members of this {{ type }} team are VERY COOPERATIVE in the way they communicate with each other. It is common for athletes on the team to share the information, resources, or ideas they have with other team members, which allows the team to work efficiently and helps members to execute specific tasks. The members also are very easy to approach and supportive of teammates achieving personal goals. Another characteristic of this team is that members are VERY COORDINATED in the way they process information. As a result of this coordination, they are very good at anticipating the actions of teammates and accomplishing tasks relevant to team success easily and efficiently. Because communication is coordinated, there is little backtracking as members know what they should be doing and how their actions impact other teammates. These characteristics have emerged from the different successes and failures that the team and its members have experienced to date.

Lower information exchange

The members of this {{ type }} team are NOT VERY COOPERATIVE in the way they communicate with each other. It is rare for athletes on the team to share the information, resources, or ideas they have with other team members about things such as how to work efficiently as a team or execute specific tasks. The members also are not easy to approach and do not encourage others when it comes to achieving personal goals. Another characteristic of this team is that members are NOT VERY COORDINATED in the way they process information. As a result of this lack of coordination, they are not very good at anticipating the actions of teammates and accomplishing tasks relevant to team success easily and efficiently. Because communication is not coordinated, there is backtracking as members are often not clear what they should be doing and how their actions impact others. These characteristics have emerged from the different successes and failures that the team and its members have experienced to date.

Appendix L: Pilot Study Network Scale

We would like you to think about the interactions (lines) between members (squares). These lines represent the flow of knowledge or information from any one member to all the other members they interact with and give a relative indication of how the team communicates as a whole. Please examine each of the four networks presented below along with the corresponding verbal descriptions, and indicate which member **network** best represents the team you read about:



- ☐ 1) Athletes on this team interact with virtually everyone else on the team (Represented by network 1)
- ☐ 2) Athletes on this team interact with about half of the other team members (Represented by network 2)
- ☐ 3) Athletes on this team interact with some of the team members (Represented by network 3)
- ☐ 4) Athletes on this team interact with very few other members (Represented by network 4)

Appendix M: Study 4/5 Recruitment Letter for Team Representatives

Hello Team Representatives,

My name is Colin McLaren and I am a PhD Candidate at the University of Saskatchewan in the College of Kinesiology. I am doing a research study looking at team communication networks and their relationship to team cohesion and performance, and I am interested in recruiting participants who play on teams in the [league]. The study involves having the players on teams who volunteer complete up to two short questionnaires (10 minutes each) before a game or practice across the first half of this season. For a few questions, participants will list the members on the team they communicate with. Participants also will answer questions assessing their perceptions of psychological variables relevant to team sport. All information obtained will be kept confidential.

I am wondering if you would allow me to seek participation from the members of your team for my study. All data collection will take place at the site of your practice or games. It is important to note that whether or not a team decides to participate in the study will have no bearing on how teams or individuals are treated within the [league], now, or in the future.

If you are interested, please e-mail me (at the address below). At that time, we can also set up a time for me to attend a game or practice to administer the first survey package. All participants will have the opportunity to enter a draw for 1 of 5 \$20 Tim Horton's gift cards each time they complete a survey.

Your assistance and consideration is greatly appreciated.

Colin McLaren
colin.mclaren@usask.ca
306-514-0416
Supervisor: Kevin S. Spink, Ph.D.

Appendix N: Study 4/5 Recruitment Script for Athletes

Hello,

My name is Colin McLaren and I am a PhD Candidate at the University of Saskatchewan in the College of Kinesiology. I am doing a research study looking at team communication networks and their relationship to team cohesion and performance of sport teams. Your involvement in this study would include completing up to two short questionnaires (10 minutes each) where you will be asked about which members on your team you communicate with as well as your perceptions of the psychological variables relevant to team sport. The first will take place today, while the remaining survey (if applicable) will be completed near midseason.

All information obtained will be kept confidential, and you can withdraw from the study at any time. Importantly, whether or not you decide to participate in the study will have no bearing on how you, or your team, are treated within the [league] now, or in the future. All participants will have the opportunity to enter a draw for 1 of 5 \$20 Tim Horton's gift cards each time they complete a survey.

Thank you for your consideration and participation.

Appendix O: Study 4/5 Participant Consent Form

You are invited to participate in a research study involving adults (18 years and older). Please read this form carefully. If you have any questions now or during the study, please feel free to ask the researchers directly, or contact the researchers via email or phone using the information listed below. This study forms a portion of the researchers' overall program of group research.

Project Title: Team communication networks: A longitudinal perspective

Researchers:

Colin D. McLaren
Ph.D. Candidate
College of Kinesiology
University of Saskatchewan
Tel: (306) 966-1099
Email: colin.mclaren@usask.ca

Dr. Kevin S. Spink
Professor
College of Kinesiology
University of Saskatchewan
Tel: (306) 966-1074
Email: kevin.spink@usask.ca

Purpose: In this study, we are interested in examining team communication networks and their relationship to important psychological outcomes relevant to team sport (e.g., team cohesion).

Procedure: Your participation will involve responding to a series of questionnaires that pertain to team processes and the perceived team environment of your current team on up to two different occasions throughout this season (10 minutes each time for a total time commitment of approximately 20 minutes). These will take place across the first half of this current season. If you choose to participate, confidentiality is assured in that only the researchers will be able to link your identity to your responses.

Potential Benefits: As a participant, you will be making important contributions to the research literature. There are no personal benefits to participating in this study, although the findings from this study will help sport psychology researchers to better understand team cognition in sport.

Potential Risks: Participation in this study presents no anticipated risks.

Storage of Data: Electronic data will be copied to an external drive and will be locked by password in read-only format. Only the researchers will have access to the data. No data will be stored on any computer hard drives once the study is complete. This data will also be backed up using the University of Saskatchewan secure cabinet on PAWS. The data will be stored for a minimum of five years after completion of the study. If the researcher chooses to destroy the data after the five years, it will be destroyed beyond recovery. This is standard protocol for any data that may be published in an academic journal or presented at a professional conference.

Confidentiality: Steps will be taken to ensure confidentiality. You will not be required to provide your name on the survey, only your specific uniform number as part of a unique identification number. Further, after all responses are tabulated, all names from the social network items names will be replaced with the unique participant ID codes such that participant names could not possibly be identified. This code also will be used to link your responses over

time. While every effort will be taken to maintain member confidentiality, there are limits on the level of confidentiality that the researcher can assure. Because members will be identifying teammates for some questions, it is possible that teammates might become aware of who was and was not listed. The researcher will safeguard the confidentiality of these lists, but cannot guarantee that other members of the team will do so. Please respect the confidentiality of your teammates by not disclosing your lists either inside or outside of the team, and be aware that teammates may not respect your confidentiality. Your consent form, responses, and the Master Lists containing all names and unique identification numbers will be stored separately, and any data reported will be aggregated such that individual responses are not identifiable.

Right to Withdraw: Your participation in this study is voluntary and you are free to answer only the questions that you are comfortable answering. Also, you may return a blank questionnaire package in the envelope if you wish not to participate after reading this consent form. You may withdraw from the research prior to final survey completion for any reason, without penalty of any sort. If you withdraw from the study before the final survey is completed near the end of the season, any data that you have contributed will be destroyed. However, once you have submitted your survey responses, the right to withdraw will extend to September 30, 2017. After this date, it is likely that some study results will have already been disseminated, and it will not be possible to withdraw your data.

Questions: If you have any questions concerning the research project, please feel free to contact the researchers at any time using the phone numbers/email addresses provided above. This research project has been approved on ethical grounds by the University of Saskatchewan Research Ethics Board. Any questions regarding your rights as a participant may be addressed to that committee through the Research Ethics Office (ethics.office@usask.ca or 306- 966-2975). Out of town participants may call toll-free (888-966-2975).

Study Results: Data from this study will be used for completion of Colin McLaren's PhD thesis, and may be published in an academic journal, or presented at a professional conference. If you would like a summary of the findings from this study, please email the primary researcher (kevin.spink@usask.ca). Or, you can check the box on the study compensation page that offers a chance to provide your e-mail. This is the same page where you can enter the gift card draw.

Compensation: All participants will have the opportunity to enter a draw to win 1 of 5 \$20 Gift Cards from Tim Horton's each time a survey is completed (maximum two entries).

Consent to Participate:

Your signature below indicates that you have read and understand the description provided. I have had an opportunity to ask questions and my questions have been answered. I consent to participate in the research project. A copy of this Consent Form has been given to me for my records.

Name of Participant	Signature	Date
<hr/>		
Researcher's Signature	Date	

Appendix P: Study 4 Participant Questionnaire

Demographic Questionnaire

The following questions are designed to allow us to find out about those who completed the survey as well as their sport-related experiences.

- 1) Participant ID Code: League-Division-Team-_____ (enter uniform number)
- 2) What is your age (in years)? _____
- 3) What is your gender? _____
- 4) How many years have you played [sport]? _____
- 5) How many years have you played on/with your specific team? _____
- 6) How many years have you played in the [league]? _____
- 7) What position(s) do you primarily play? _____
- 8) Describe your starting status (choose the option that best applies): Starter Non-starter
Practice Player

Group Cohesion- Positively-worded version (Eys et al., 2007) of the Group Environment Questionnaire (Carron et al., 1985)

The following statements are designed to assess your perceptions of YOUR TEAM AS A WHOLE. Please circle a number from 1 to 9 to indicate your level of agreement with each of these statements.

- | | | | | | | | | | |
|--|---|---|---|---|---|---|-----------------------|---|--|
| 1. Our team is united in trying to reach its goals for performance | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| Strongly Disagree | | | | | | | Strongly Agree | | |
| 2. We all take responsibility for any loss or poor performance by our team | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| Strongly Disagree | | | | | | | Strongly Agree | | |
| 3. Our team members have similar aspirations for the team's performance | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| Strongly Disagree | | | | | | | Strongly Agree | | |
| 4. If members of our team have problems in practice, everyone wants to help them so we can get back together again | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| Strongly Disagree | | | | | | | Strongly Agree | | |

5. Our team members communicate freely about each athlete's responsibilities during competition or practice

1 2 3 4 5 6 7 8 9
Strongly Disagree **Strongly Agree**

Social Network

Team sport is unique in that teammates must coordinate their actions to be successful. This can be seen in the way that teammates communicate with one another. These communications involve the sharing of knowledge, information, or ideas. We would like you to think about the members on your team as you answer the following questions. For each question, you can select as few as no members or as many as all members.

Take a moment and think about your most recent game. We would like you to place a checkmark under the name of ONLY THOSE MEMBERS THAT APPLY to each statement (do not select yourself). First, enter the names of each teammate in attendance at this game in the vertical columns.

	[Enter name here]	[Enter name here]	[Enter name here]	[Enter name here]	[Enter name here]	[Enter name here]	[Enter name here]	[Enter name here]	[Enter name here]	[Enter name here]	[Enter name here]	[Enter name here]
1. I openly exchanged information with these team members during the game												

Appendix Q: Study 5 Participant Questionnaire

Demographic Questionnaire

The following questions are designed to allow us to find out about those who completed the survey as well as their sport-related experiences.

- 1) Participant ID Code: League-Division-Team-_____ (enter uniform number)
- 2) What is your age (in years)? _____
- 3) What is your gender? _____
- 4) How many years have you played [sport]? _____
- 5) How many years have you played on/with your specific team? _____
- 6) How many years have you played in the [league]? _____
- 7) What position(s) do you primarily play? _____
- 8) Describe your starting status (choose the option that best applies): Starter Non-starter
Practice Player

Group Cohesion- Positively-worded version (Eys et al., 2007) of the Group Environment Questionnaire (Carron et al., 1985) *MEASURED AT EARLY AND MIDSEASON*

The following statements are designed to assess your perceptions of YOUR TEAM AS A WHOLE. Please circle a number from 1 to 9 to indicate your level of agreement with each of these statements.

- | | | | | | | | | | |
|--|---|---|---|---|---|---|-----------------------|---|--|
| 1. Our team is united in trying to reach its goals for performance | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| Strongly Disagree | | | | | | | Strongly Agree | | |
| 2. We all take responsibility for any loss or poor performance by our team | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| Strongly Disagree | | | | | | | Strongly Agree | | |
| 3. Our team members have similar aspirations for the team's performance | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| Strongly Disagree | | | | | | | Strongly Agree | | |
| 4. If members of our team have problems in practice, everyone wants to help them so we can get back together again | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| Strongly Disagree | | | | | | | Strongly Agree | | |

5. Our team members communicate freely about each athlete's responsibilities during competition or practice

1 2 3 4 5 6 7 8 9
Strongly Disagree **Strongly Agree**

Social Network *MEASURED AT EARLY SEASON ONLY*

Team sport is unique in that teammates must coordinate their actions to be successful. This can be seen in the way that teammates communicate with one another. These communications involve the sharing of knowledge, information, or ideas. We would like you to think about the members on your team as you answer the following questions. For each question, you can select as few as no members or as many as all members.

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	[Enter name here]	[Enter name here]	[Enter name here]	[Enter name here]	[Enter name here]	[Enter name here]	[Enter name here]	[Enter name here]	[Enter name here]	[Enter name here]	[Enter name here]	[Enter name here]
1. I openly exchanged information with these team members during the game												